Economy and Interaction: Exploring Archaeobotanical Contributions in Prehistoric Cyprus

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Abstract

Recent archaeobotanical results from early Aceramic Neolithic sites on Cyprus (c. 8,500 cal. BC) have put the island in the forefront of debates on the spread of Near Eastern agriculture, with domestic crops appearing on the island shortly after they evolved. The archaeobotanical results from these early Cypriot Aceramic Neolithic sites changed conventional views regarding the Cypriot prehistoric economy, specifically the timing of the introduction of farming to the island. However, what happened after the introduction of agriculture to Cyprus has been less discussed. This thesis explores the role of new crop introductions, local agricultural developments, and intensification in subsequent economic and social developments on Cyprus corresponding with the island's evidence of ongoing social transformations and changing off-island patterns of contacts. In addition to contributing to discussions on the origins and spread of Near Eastern agriculture, this thesis contributes to current archaeological debates on external contact and the influence of the broader Near East on the development of the island's prehistoric economy. Further, the primary objective of this research is the comparative quantitative analysis of the Cypriot charred macro botanical record including archaeobotanical data from four recently excavated Cypriot sites, Krittou Marottou-'*Ais Yiorkis*, Kissonerga-*Skalia*, Souskiou-*Laona*, and Prastion-*Mesorotsos*. This research is a chronological and regional analysis of the botanical record of Cyprus and a comparison of data from similarly dated sites in the Levantine mainland, Turkey, and Egypt.

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To My Parents

Chapter 1

Introduction to Research Aims and Objectives

1.1 Introduction

In the last thirty years there has been a great change in the understanding of the prehistory of Cyprus. Specifically, Cyprus has gone from an island on the periphery to cultural developments in prehistoric Southwest Asia to one that is now known to have played a key role in the spread of early agriculture. Prior to the late 1980s, the earliest evidence for human occupation on the island dated to c. 6,000 cal. BC. Since then evidence has demonstrated human activities on the island starting in the early 10th millennium BC (Simmons 2004). Current evidence from early Aceramic Neolithic sites on the island, dated to c. 8500 cal. BC, have put the island in the forefront of debates on the development and spread of agriculture in Southwest Asia. Recent data indicate that domestic cereal crops as well as animals, including evidence for the first commensals outside of the Levant and domesticated cat and dog, appear at nearly the same time on Cyprus as the mainland. The island is the first region to be colonized after the emergence of agriculture in the Levant and it was the earliest target for migration by farmers (Colledge *et al.* 2004; Lucas et al. 2012; Peltenburg *et al.* 2000; Peltenburg *et al.* 2003; Vigne *et al.* 2011a; Willcox 2003). Accordingly, Cyprus is a key region for research on the transition to, and spread of, agriculture into new areas. However, what happened after the introduction of agriculture to Cyprus has been relatively under researched. Further consideration is needed of the role of new crop introductions, local agricultural developments, agricultural intensification in subsequent cultural phases (i.e. the Pottery Neolithic, the Chalcolithic and the Bronze Age), and changes in food preparation and consumption technologies, which will provide evidence for interaction with surrounding geographical regions and increased social complexity. This thesis explores the dynamics of the spread of Near Eastern crop-based agriculture to the island of Cyprus, the development of the Cypriot prehistoric economy, including agricultural developments and cultural changes in food preparation and consumption technologies, and the influence of contemporary mainland Levantine cultural developments on these processes.

This chapter will present the research aims and objectives of this thesis followed by an introduction to the research questions. An overview of the origins and development of crop-based agriculture will be provided followed by an introduction to previous interpretations of early Cypriot agricultural systems and food culture and food preparation and consumption technologies. The research questions and methods will then be presented and a chapter outline provided.

1.2 Research Aims and Objectives

The primary objective of this research is the comparative quantitative analysis of the Cypriot archaeobotanical (i.e. plant remains recovered from archaeological contexts) record. This analysis includes data from four recently excavated sites on the island and a chronological and regional comparison of published evidence from Cyprus and the Near Eastern mainland; including archaeobotanical data from sites located in Iran, Iraq, Turkey, Syria, Israel, Jordan, and Egypt, and dated to the Pre-Pottery Neolithic (hereafter PPN or Aceramic Neolithic), the Pottery Neolithic (hereafter PN or Ceramic Neolithic), the Chalcolithic, and the Early and Middle Bronze Age. Archaeobotanical data from Krittou Marottou-'*Ais Yiorkis*, Kissonerga-*Skalia*, Souskiou-*Laona*, and Prastion-*Mesorotsos*, all located in Cyprus, will be used to address questions regarding the subsistence practices at the site-level and on a regional scale for the corresponding cultural phases, PPN, Early/Middle Bronze Age, Chalcolithic, and Late Ceramic Neolithic/Chalcolithic, respectively. Archaeological and artefact data from sites located in Cyprus and dated to the previously mentioned cultural phases will be used to address questions regarding food preparation and consumption technologies. Data from Cyprus and comparative data from sites located on the mainland Levant will be used to address questions with respect to regional and chronological changes in agriculture and food culture and technology over time.

1.3 General review of agricultural origins and its spread to Cyprus

Gordon Childe (1936) described the transition to agriculture, the "Neolithic Revolution" and the emergence of the urban state, the "Urban Revolution", as the two most significant developments in human history. The former provided the likely foundation for surplus production which supported the emergence of the latter (Fuller *et al.* 2010, 13-14). It is remarkable that the transition to agriculture took place independently in multiple regions in the world beginning at roughly the same time (Price and Bar-Yosef 2011, 11). There are up to 24 (Fuller 2010; Purugganan and Fuller 2009) geographical regions in the world where agriculture developed independently and each region saw the domestication of a different suite (or 'package') of crops and animals and involved different chronologies, environments, technology, and cultural trajectories (Diamond 2002; Zeder 2006).

Why the transition to agriculture began when and where it did has been extensively researched and explanations have been summarised by several authors, including Price and Bar-Yosef (2011), Harris (1996), Bellwood (2005), Barker (2006), and Thorpe (1996). The transition to agriculture can be viewed in terms of domestication origins and dispersals of plants. The centers of origins (Vavilov 1926) or 'hearths of domestication' (Sauer 1952) are the regions where the plants and animals were domesticated and the secondary locations are the regions where agriculture and the 'Neolithic package' dispersed. This 'package' is characterized by regional variations in both plant and animal composition and exploitation patterns at the onset of the domestication process as well as in its dispersal (Conolly *et al.* 2011). In other words, the crops and animals did not spread as a complete 'package' as such, but rather each species has its own domestication and 'dispersal story' (Conolly *et al.* 2011; Colledge *et al.* 2004; Vigne; 2008; Zeder 2008). On the basis of previous interpretations the transition to agriculture in the Near East was considered to be a rapid process that involved a package of eight 'founder crops' which were domesticated in a 'core' region with a subsequent dispersal of this 'package' from the regional centre (Lev-Yadun *et al.* 2000; Zohary 1996, 1999; Abbo *et al.* 2010). However, in light of recent collated archaeobotanical data, a quite different picture emerges. Results of recent research are somewhat contradictory. They indicate that the process of plant domestication was slow (occurring over 3000 years), involved multiple domestication events and occurred in a more geographically dispersed area extending far beyond the previously held domestication 'core' area (Fuller *et al*. 2011).

Explanations for why hunter-gatherers became farmers have generally been categorised into either 'push' (i.e. food stress) or 'pull' (i.e. food choice with social motivations) models (Fuller 2003; Price and Bar-Yosef 2011; Barker 2006). That is, hunter-gatherers were either 'pushed' or 'pulled' into agriculture as a result of environmental stress (Childe 1936; Wagner 1977), population pressure (Boserup 1965; Flannery 1969; Binford 1968), or "pulled" through changing social structures (Hayden 1990, 1995;

Cauvin 2000; Hodder 1990). Further, the dynamics of its dispersal have been argued to be a result of a mixture of either cultural (Edmonson 1961) and 'demic' diffusion (e.g. 'wave of advance') (Ammerman and Cavalli-Sforza 1971) or a mixture of the two (Alexander 1978; Colledge *et al.* 2004; Price 2000). The former involved the dispersal of domesticated crops, animals and technology with the adoption of farming by native hunter-gatherer populations (Zvelebil and Rowley-Conwy 1986) and the latter involved the spread of agricultural populations into new areas (Ammerman and Cavalli-Sforza 1971). Alexander (1978) discussed mobile (or 'moving') frontiers and stationary (or 'static') frontiers, which Bellwood (2000) later describes as 'spread' and 'friction zones', respectively (Alexander 1978; Bellwood 2000; Zvelebil 1996); the former developed during periods of agricultural expansions (e.g. colonisation by demic diffusion) and the latter developed in a more stable or gradually changing circumstances allowing for contact and exchange between the two groups (Alexander 1978; Barker 2006; Bellwood 2005; Zvelebil 1996).

On Cyprus the dispersal story of agriculture is one of demic diffusion, more specifically a targeted migration by farming populations from Southwest Asia in the Early PPNB (Colledge *et al.* 2004; Guiliane and Briois 2001; Peltenburg *et al.* 2000; 2003; Willcox 2003). As mentioned briefly above, less than thirty years ago it was thought that the population of the island by farmers occurred at a relatively late date, c. 6,000 cal. BC. Current research however, demonstrates a human presence before this time of hunter-gatherer populations during both the Epipalaeolithic (Akrotiri Phase) (Simmons 2004) and the Cypro-Pre-Pottery Neolithic A (McCartney *et al.* 2007, 2008; Vigne *et al.* 2011b) as well as agricultural communities during the Cypro-Early Pre-Pottery Neolithic B (Guiliane *et al.* 2011; Guiliane and Briois 2001; Peltenburg *et al.* 2003; Vigne *et al.*. 2011). The dynamics of the spread of farming to Cyprus demands investigation in light of recent evidence for continued occupation on the island, albeit ephemeral in the earliest phases. At this time what is known is that farmers from the mainland migrated to the island during the Cypro-Early PPNB. However, the extent to which possible residual hunter-gatherer groups interacted or assimilated with the PPNB farmers is not known. For example, there are indications that Cyprus continued hunting the Mesopotamian fallow deer alongside farming during the PPNB, PN, Chalcolithic, and Bronze Age which encourages an exploration of the dynamics of hunting and farming lifestyles.

1.4 Agricultural systems and change

The creation of cultural artefacts involves a sequence of events to produce the end product, whether it is a stone tool, a ceramic vessel, or bread. Each stage of this *chaîne opératoire* produces waste, and thus evidence, for each stage of the sequence in the archaeological record. The nature of subsistence economies, which is agricultural systems, food processing and consumption technologies, can be thought of in terms of this *chaîne opératoire*. With regards to cereal agriculture, this sequence includes primary production, procurement, early processing, distribution, preparation (late processing), consumption, and disposal; each with its associated material culture and potential charred plant by-products (**Table 1.1**) (Fuller 2005; Goody 1982; Samuel 1999; Wilkinson and Stevens 2008). This section discusses the systems involved in the primary production, which are the agricultural regimes that occur pre-harvest. The different types of agricultural systems will be presented, as well as the dynamics of changes in these systems over time, including the primary motivations that drive agricultural change (i.e. intensification or extensification) and introductions of both new crops (e.g. through diversification) and agricultural technology (e.g. plough).

Before a discussion on agriculture and agricultural systems can begin it is important to clarify the terminology used in this thesis. Definitions of key terms, including cultivation, agriculture, domestication, intensification and extensification have been presented by many authors over the years (Fuller 2007; Fuller *et al.* 2011; Harris 1989; MacNeish 1992; Price and Bar-Yosef 2011) and the following definitions are a result of a combination of these. Hunting and gathering is the exploitation of wild plants and animals in their natural habitat and any modifications to either activity involves a very low investment of labour. Cultivation of wild plants involves sowing, harvesting, and re-planting in tilled soil. Cultivation has been identified in the archaeobotanical record by the presence of arable weed assemblages in association with wild cereals. The presence of arable weeds and wild cereals has been used to suggest what has been termed ‘pre-domestication cultivation’ in the Levant during the pre-pottery Neolithic (Colledge 1998, 2002; Hillman *et al.* 2001; White and Makarewicz 2011; Willcox

2011). The distinction between a wild and domesticated plant or animal is that the domesticated plant or animal differs genetically and morphologically from its wild progenitor species and is a result of either conscious or unconscious human intervention, specifically due to cultivation of plants and herding (i.e. the control of animal herds) or management of animals. Thus, as stated by Fuller *et al.* (2010, 2011) a primary difference between cultivation and domestication is that cultivation is something that people do, such as preparing the soil, sowing, and harvesting, while domestication is a genetic or morphological property of the plant that increases its adaptation to cultivation. However, other non-morphological changes have been used to infer domestication status; including age profiles, milking, bone pathologies, and evidence for the spread beyond the natural habitats of the wild species (Meadow 1989; Price and Bar-Yosef 2011). Agriculture, therefore, involves the use of domesticated plants and animals for food and other resources.

There are differences in agricultural systems which have been discussed previously in terms of ‘intensive’ and ‘extensive’ methods. Pre-harvest ‘intensive’ methods refer to agricultural systems that involve high inputs of labour per unit area, resulting in high area yields. ‘Extensive’ methods refer to systems that involve smaller inputs of labour per unit of land exploited, resulting in smaller area yields (Bogaard 2004). Intensification and extensification practices aim to protect crops, maximise yields, and create some level of surplus, whether small- or large-scale. Intensification has generally been attributed to population increase, land limitations, or a combination of both these factors. Extensification, on the other hand, has been attributed to population increase in circumstances where land is not necessarily limited and expansion is possible (Wilkinson and Stevens 2008).

With regard to past agricultural regimes in Neolithic Europe, Bogaard (2004) discusses four agricultural regimes, each with different economic and social implications. These are shifting cultivation, extensive ard cultivation, floodplain cultivation and intensive garden cultivation, all of which can be differentiated by permanence (e.g. fixed-plot or shifting cultivation, whether intensive or extensive), seasonality (i.e. spring versus autumn sowing of crops), and intensity (i.e. extensive versus intensive). With regards to seasonality, implications include both the amount of labour and time invested in cultivation practices, particularly with regards to the crop and livestock integration (i.e. manuring, etc…) and seasonal scheduling (autumn or spring sowing as in intensive garden cultivation). A method for determining these different agricultural regimes in archaeological contexts has been to use archaeobotanical assemblages of arable weeds in association with cereals, specifically using Functional Interpretation of Botanical Surveys (hereafter FIBS). FIBS provides a way of relating characteristics of plant species, particularly arable weeds associated with cultivation, to ecological variables to infer crop husbandry systems in the past and has been applied to both Near Eastern and European contexts (Bogaard 2004, 2005; Bogaard *et al.* 1999, 2001; Charles *et al.* 1997, 2002, 2003; Jones 2002; Jones *et al.* 1999, 2000; Charles and Hoppe 2003; Kreuz 2011).

Shifting cultivation or slash-and-burn cultivation involves the burning of plots for soil regeneration and as a result the need for tillage and weeding is reduced. Shifting cultivation is considered to be extensive because of the low labour input per area (Bogaard 2004; Grigg 1974; Steensberg 1976). The reverse of shifting cultivation is fixed-plot cultivation, with cultural implications including claims to land and social inequalities (Bogaard 2004). Based on modern experiments aimed at determining the rate at which plant domestication occurred Hillman and Davies (1990) assumed that shifting plots was practiced, which is a more intensive form of shifting cultivation (Fuller *et al.* 2011). Another method is extensive ard cultivation (or the animal-drawn plough), which involves less human labour per unit area with lower yields. However, because a greater amount of land is cultivatable, the ability to produce surplus on a larger scale is increased (Bogaard 2004, see also Goody 1976; Halstead 1995). Hand cultivation with tillage, weeding and manuring is more intensive than both shifting cultivation and extensive ard cultivation because it involves high amounts of human labour per unit area. Intensive garden cultivation utilizes hand cultivation techniques and involves intensification methods including dibbling or row-sowing, hand-weeding or hoeing of crops, manuring and water management (Bogaard 2004 also refer to Halstead 1987, 1989; Jones 1992; Jones *et al.* 1999). Intensive mixed farming involves the integration of small-scale intensive garden cultivation and intensive livestock herding, with mutually exclusive benefits for both livestock and crops. The benefits for crops are that the animals provide manure for soil fertilization (whether it is collected manually or as a result of grazing) and the livestock help with tillage and the prevention of lodging. The primary benefit for the livestock is that the crop by-products can be used as fodder (Bogaard 2005).

Models of agricultural regimes previously proposed for the Near East include Sherratt's (1980) progressive system that begins with fixed-plot horticulture and progresses to flood-water farming and then to plough-based agriculture with greater woodland clearance and large-scale irrigation systems. Recent research (Bogaard 2004, 2005) suggests that the most likely cultivation regime for early Neolithic sites in the Near East and Neolithic Linearbandkeramik (hereafter LBK) Europe is an intensive mixed farming system, which was previously proposed by Halstead (1987). This regime involved autumn-sowing of fixed-plots with high inputs of labour through tillage and weeding and integration between crops and animal husbandry through manuring of crops and animal grazing of fallow fields (Bogaard 2004, 2005). According to Bogaard (2004), Cyprus contributes to discussions on intensive mixed farming regimes, with evidence for this practice on the island by the end of the ninth millennium BC (Peltenburg *et al.* 2001). Beyond this statement, there has been very little research on early Cypriot agricultural practices and intensification to date.

Intensification of crop-based agriculture on the island has been recognised in the Cypriot Chalcolithic to coincide with a general decrease in hunting and an increase in herding (Murray 1998). The evidence in Cyprus for a distinctive insular adaptation involving the controlled hunting and a system of game management of fallow deer throughout the Aceramic Neolithic, Ceramic Neolithic and Chalcolithic occupations has been discussed in previous publications (Croft 1991; Peltenburg *et al.* 2000). This economic strategy has been viewed as 'de-intensification' (i.e. decrease in agricultural practices) of agriculture on the island since the hunting of deer increases in importance, with fallow deer constituting over 70% of the Ceramic Neolithic and Early Chalcolithic assemblages (Clarke *et al.* 2007). Clarke *et al.* (2007, 62) suggest that the evolutionary pressures, including demographic pressure and sedentism, that drove agricultural intensification on the mainland were absent on Cyprus and as a result, de-intensification occurred. The dynamics of this agricultural regime in connection with the hunting culture of Cyprus will be explored in Chapter 7.

In a discussion of crop introductions to Cyprus, Colledge and Conolly (2007, 61) present the likelihood of multiple importation events of domestic plant taxa to the island in the Neolithic with increases in the number of domestic crops from the Cypriot Early Pre-Pottery Neolithic Phase B to the ceramic Neolithic. They reference Horwitz *et al.* (2004) and highlight the similarities between the botanical and faunal evidence, with the latter suggesting at least five separate importation events of wild animal species at Parekklisha-*Shillourokambos* (Colledge and Conolly 2007; Horwitz *et al.* 2004); however, Vigne (2009, 2011) argues for a more complex situation entailing multiple waves of introductions of wild and domesticated animals and considers the possibility of indigenous domestication of goats after 7500 cal. BC and the replacement of domestic sheep by a new domestic type. This research will explore the nature and impact of external contact by examining the possible various importation events along with evidence of non-native wild herbaceous taxa and domestic crops. An analysis of the non-native wild and domestic taxa has the potential to suggest origins and possibly define the direction from which farming spread to Cyprus (Colledge and Conolly 2007).

1.5 Relationship of early agriculture to food culture and technologies

This section discusses food culture and technologies, particularly with regards to the procurement and the post-harvest processing of crops, including distribution, preparation, and consumption. The procurement of crops, including the material culture and plant by-products associated with the post-harvest processing activities will be introduced. A discussion of the prehistoric Near Eastern food culture and the technologies and material culture associated with distribution, preparation, and consumption will follow.

In reference to prehistoric post-harvest early processing of cereal crops there are relatively few ways in which the sequence can be done (Hillman 1973, 1981, 1984; Jones 1987; Wilkinson and Stevens 2008). As stated by Wilkinson and Stevens (2008, 195) at its most basic the activities of early processing involve those that break things apart and those that separate things out, with the objective a semi-cleaned or fully cleaned grain that can be stored and further processed into food during late processing preparation. Since the goal is a semi-cleaned or cleaned grain store then it can be expected that the proportion of weed seeds to grain will lessen through the *chaîne* *opératoire* so the final stages will comprise grains and few weed seeds. Further, the weed seed by-products from each phase will be determined by their size, weight and their ability to separate from grain (e.g. chaff) (Fuller and Stevens 2009; Hillman 1981,1984; Jones 1984, 1987). The primary steps of early processing include threshing, winnowing, and coarse- and fine-sieving, each with signature plant by-products and material culture as evidence for that stage in the sequence (**Table 1.1**).

The next stage in the sequence is distribution, which includes the storing of the semi-cleaned or cleaned grain along with any residual weed seeds left over from coarse and fine-sieving. Artefacts associated with storage and distribution includes ceramic storage vessels, basketry (rarely preserved), silos and bins. Late processing of cereal crops includes the preparation of grain into food (e.g. from grain to bread). The material culture associated with late processing may include basketry, cooking vessels, ground stone tools (e.g. mortars and querns), hearths, and ovens. In addition to charred remains of food (e.g. grain or bread) evidence for what was consumed and the technologies involved can be inferred from serving containers (e.g. made of ceramic and stone).

As stated by Fuller (2005, 761), it is recognised that cuisine is regionally and culturally distinctive and thus, there are expectations that Indian, Italian, Japanese or French foods contain different ingredients and are prepared and consumed in different ways. Thus, culinary traditions in food preparation and consumption are evident cross-culturally (Goody 1982; Haaland 2007; Rowlands and Fuller 2010) and these food systems go back before the origins of agriculture to hunting and gathering populations (Rowland and Fuller 2010). Differences between food selection and preparation and consumption technologies have recently been examined, with roasting and grinding technologies characteristic of western Eurasia (i.e. the Near East and Mediterranean); boiling of porridge and brewing of beer with pottery in Africa; boiling and steaming in eastern Eurasia (i.e. China and the Far East); and a mixture of food cultures characteristic of South Asia (Fuller and Rowlands 2011, 37; Goody 1982; Haaland 2007; Rowlands and Fuller 2010). However, it is the Near Eastern trajectory of grinding, roasting, and baking that is most pertinent to an understanding of the Cypriot food culture because these processes are characteristic of the mainland Levant, and from where the earliest migrant farmers originated. To unravel the Near Eastern food culture the archaeological record is used in addition to the archaeobotanical data since artefacts often provide information on food production (e.g. ground stone for grinding grain to flour or cooking pots for boiling) and consumption (e.g. pottery for serving).

In the Near East there is an emphasis on the hearth, the oven, and the house as opposed to the pot in African traditions (Haaland 2006). There is substantial evidence for grinding of wild cereals (and other species) into flour to be baked into bread or bread cakes as early as the Epipalaeolithic, at Ohalo II (Piperno *et al*. 2004). Since grinding tools precede any evidence for pottery or ovens in this region it has been inferred that the bread was baked in open hearths, as 'ash-baked' bread (Haaland 2006). The earliest evidence for ovens (i.e. stone-filled, cylindrical pits) in this region comes from the PPNA at Mureybet (Cauvin 2000). Ovens become more widespread in later PPN levels, from ca. 7000 BC (Fuller and Rowlands 2011; Rowlands and Fuller 2010; also see Maisels 1990). Evidence from PPNA Jerf el Ahmar (dated to c. 9000 cal. BC) in particular provides insight into early Near Eastern food processing from an area interpreted to be a "kitchen" (Willcox 2002). The kitchen or preparation area contained archaeobotanical and artefactual evidence, including saddle querns, flat polished stone plates, limestone basins, a limestone bowl, pounding stones, and a hearth suggesting the soaking of barley, grinding of einkorn wheat and the preparation of seed cakes made from a mustard species with high seed oil content (i.e. *Brassica/Sinapis*) (Willcox 2002). There is evidence of circular bread ovens, or tannurs, in the Middle PPNB (Akkermans and Schwartz 2003; Wright 2000) and a correlation between the appearance of ovens to changing domestic architecture, with a change from round houses to rectangular houses and an emphasis on storage facilities noted (Haaland 2006). With regards to pottery, Fuller and Rowlands (2011) argue that ceramics and grinding can be considered functional alternate adaptations for post-harvest intensification. In the Near East where ceramic technology developed after agriculture and grinding technology, the appearance of pottery was not associated with food preparation (i.e. boiling), as in Africa, but rather with food storage and consumption (i.e. cooking, serving, and drinking) (Atalay and Hastorf 2006; Haaland 2006, 2007). Thus, the introduction of pottery in the Near East meant new ways of preparation and consumption, including new ways of elaborating cooking (possibly mixed meat and plant dishes such as casseroles and stews) and serving (e.g. cups and small bowls) (Rowlands and Fuller 2010; Moore 1995, 47-48).

The archaeological evidence of Cyprus differs in many respects from the cultures of the contemporary mainland (discussed in Chapter 2). These differences are evident in domestic architecture, with the persistence of circular structures up to the EBA, the timing of the introduction of pottery and appearance of ovens, changes in agricultural practices, and the reliance on deer hunting. The evidence suggests that the island's colonists may "have retained many aspects of their earlier mainland lives" (Peltenburg 2004, 77). If the evidence demonstrates that Cyprus deviated from the mainland trajectory with regards to architecture and technological innovations during the PPNB, does it also show a divergence in food culture as well? This thesis will consider the archaeobotanical and artefactual evidence of Cyprus in an examination of the island's early food culture and technology.

1.6 Agriculture and the emergence of the Cypriot Bronze Age

As introduced above, the relationship between agriculture and the emergence of the urban state is that agriculture was a precursor to urbanization because it provided the production of surplus (through intensification) needed to support craft specialisation, social hierarchies, trade, and the emergence of social complexity (Childe 1936; Diamond 2002; Fuller *et al.* 2010; Purugganan and Fuller 2009). As stated by Renfrew (1982, 267), 'no complex society can function unless the level of subsistence production is sufficient to feed a range of specialists, including the leaders and organisers, in addition to those engaged in food production.' There are three significant elements of agricultural production that supported trade and have been connected with the emergence of social complexity; these are surplus production, labour mobilisation and the production of "cash crops" (Sherratt 1999; see also Fuller and Stevens 2009). Evidence for urbanization in Cyprus comes from the Late Bronze Age. It marks a period of great social and economic change on the island, with substantial population increase, settlement in new regions of the island, changes in pottery, restructuring of craft-specialisation from domestic to large-scale production, increased social complexity, enhanced international trade networks, in the copper industry in particular, and the emergence of hierarchy and the urban state (Steel 2004, 149-150). This thesis examines the archaeobotanical evidence for increasing social complexity leading up to urbanization in the Cypriot Late Bronze Age.

Surplus production and the way in which communities store and process surplus can provide insight into increasing social complexity. A recent study by Fuller and Stevens (2009) illustrates how archaeobotanical data can contribute to evidence for changes in labour mobilization, or shifts in the structure of labour with regards to crop-processing at a site or regional level and further identify the relationship between agricultural production and social complexity. The degrees of labour mobilisation between *focused* (i.e. no more than single nuclear family), semi-large scale (i.e. extended family) and large-scale (beyond extended family) mobilisation is evident in the archaeobotanical record by evidence from storage practices and the timing of late processing of stored crops. The authors note that the storing of crops as 'clean grain' will require more labour and an ability to organise the workforce around harvest. In opposition, if the crops are stored with limited processing, the labour likely falls at the household level (Fuller and Stevens 2009). In Cyprus there is little evidence for intensification of labour and the control of surplus production prior to the Late Chalcolithic (e.g. Period 4, Kissonerga-*Mosphilia*) (Peltenburg 1993). Evidence of intensification of labour and surplus control comes from archaeological evidence of increased potential volumes in centralized storage containers (e.g. evidence from pottery) and a standardization and increase in crop processing tools (i.e. querns, mortars, and polished blades) (Peltenburg *et al.*. 1998). A re-assessment of the evidence for, and relationship between, increasing social complexity and labour mobilisation in Cyprus will be explored in this thesis.

The secondary products revolution (hereafter SPR), first described by Sherratt (1981), involves a transition between a subsistence based on hoe-cultivation and animals kept for meat consumption to plough agriculture and the exploitation of animals for their secondary purposes. This revolution involves animals and their secondary products and services (i.e. milk, wool, transport abilities, and traction) and has recently has been argued to coincide with a tree crop and vine revolution, with perennial orchard crops and their secondary products (i.e. olive oil for consumption and ointments, wine, dried fruit, and textile fibers) (Fall *et al.* 2002; Fuller 2008; Sherratt 1999). As discussed by Greenfield (2010, 29-30) the innovations of this shift "led to a revolution in food production, mobility, local and inter-regional exchange and settlement patterns." It is the surplus of these secondary commodities, the "cash crops", that facilitated specialized markets with goods sold for profit and regional exchange in the emergence of complex societies (Fall *et al.* 2002; Fuller 2008; Sherratt 1981, 1999) and thus, as stated by Sherratt (1981, 263), the SPR is not just a matter of subsistence and economics but it represents a threshold in social development. The "cash crops" are those items that are grown for the purpose of trade and require specialisation in processing as opposed to crops used for household consumption (i.e. crops for 'subsistence') (Sherratt 1999). The stereotypic "Mediterranean triad" or "polyculture", which consists of cereals together with wine and olive oil production, is seen as the classic Bronze Age economy and has traditionally been viewed as a marker of the 'emergence of civilisation" (Hamilakis 1996, 1999; Renfrew 1972). However, Hamilakis (1999) argues that there is a lack of evidence in support of the Mediterranean polyculture in the Early Bronze Age. Since these "cash crops" are both risky and labour intensive, the industry is powered by market economies and ran by 'wealthy' farmers (i.e. individuals with additional resources) that can afford the risk associated with these crops (Forbes 1993; Hamilakis 1999). The origin of the market economy in Cyprus dates to the Late Bronze Age and therefore it is unlikely that the development of "cash-crops" on the island preceded urbanization.

1.7 Research Questions

The questions addressed in this thesis have been introduced in the previous sections of this chapter. In this section there is an outline of the questions to be addressed in the subsequent chapters.

1) This research includes the archaeobotanical results from four recently excavated Cypriot sites, Krittou Marottou-'*Ais Yiorkis*, Kissonerga-*Skalia*, Souskiou-*Laona*, and Prastion-*Mesorotsos.* The following questions will be addressed for each site:

    a. Are there differences between samples and/or context type?

    b. What plant species are present in the samples?

2) This research is the first to assemble and analyse the Cypriot archaeobotanical record from sites dated from the earliest settlers to the Bronze Age. The following research questions will be addressed using this dataset as a re-assessment of the Cypriot botanical record on a regional level:

    a. Does the botanical data provide evidence for one or multiple introductions of cereal crops to the island?
    b. What does the botanical data contribute to this idea of the spread of early agricultural 'packages'?
    c. If there is evidence for multiple crop introductions, does it provide an index of varietal diversification through the adoption of new crops in the Cypriot prehistoric economy?
    d. What can the botanical data reveal about early agricultural practices in Cyprus, specifically with regards to permanence, seasonality, and intensity?
    e. Is there evidence of agricultural intensification or extensification, both pre- and post-harvest, prior to the Late Chalcolithic?
    f. Further, what does the botanical evidence contribute to debates of economic 'de-intensification' in light of the island's unique hunting economy?

3) With regards to food culture and technologies, artefactual evidence from excavations in Cyprus will be used to explore cultural aspects of food preparation and consumption and changes in these over time. The following research question will be addressed:

    a. Does the artefactual and botanical data of Cyprus provide evidence for the Near Eastern grinding/roasting/baking food culture?

4) Archaeobotanical data from Cyprus and comparative data from sites located on the mainland Levant will be used to address questions with regards to regional and chronological change in agriculture over time. The following questions will be addressed:

a. Are there regional and/or chronological patterns evident in the archaeobotanical assemblages (i.e. crops and arable weed assemblages) of Cyprus and the mainland Levant over time?
b. If so, what can these patterns reveal about interaction between the two regions during the AN, CN, Chalcolithic, and Bronze Age?
c. Further, what can these patterns reveal about the emergence of social complexity in Cyprus and the development of the Cypriot Late Bronze Age economy?

1.8 Archaeobotanical Samples

A total of 8,721 litres from 217 samples were processed for the analyses of charred plant materials recovered from Krittou Marottou-*'Ais Yiorkis*, Prastion-*Mesorotsos*, Souskiou-*Laona*, and Kissonerga-*Skalia*. All previously published archaeobotanical material from Cyprus, data from contemporary mainland sites, and the new botanical data presented here have been entered into an ACCESS database which will be used in the comparative analysis, which will be discussed in Chapter 3.

1.9 Organisation of the thesis

This thesis is divided into seven chapters. Chapters 2 through 4 provide the environmental, archaeological, and archaeobotanical background for this research. Chapter 2 is an introduction of the environmental and archaeological context of Cyprus and the mainland Levant during the Aceramic Neolithic to the Middle Bronze Age. In Chapter 3 there is a discussion of the archaeobotanical methods used in the analysis of the archaeobotanical material from four recently excavated sites, the Cypriot botanical record, and in the regional comparison. Chapter 4 presents a summary and critical review of the archaeobotanical record of Cyprus. The results, a synthesis, and conclusions are provided in Chapters 5 through 7. Chapters 5 and 6 present the results and an interpretation, the conclusion, and suggestions for future research are presented in Chapter 7.

Table 1.1 Chaîne opératoire of food and possible archaeobotanical datasets for cereals (taken from Goody 1982, 37; Fuller 2005, 762; Samuel 1999, 124, 130; Hillman 1981, 1984; Jones 1987; Wilkinson and Stevens 2008; Fuller et al 2010; Fuller and Stevens 2009)

<table>
<tr><th></th><th colspan="2">Activity</th><th>Material Culture</th><th colspan="2">Plant Material</th></tr>
<tr><td>Pre-harvest Primary Production</td><td colspan="2">tilling, manuring, sowing</td><td>plough</td><td colspan="2"></td></tr>
<tr><td>Procurement</td><td colspan="2">harvesting
(by uprooting, plucking, or cutting with sickle)</td><td>chipped stone (e.g. lithic blades, sickle blades)</td><td colspan="2">chaff, grains, weeds (size depends on uprooting or harvesting by sickle either high or low on culm)</td></tr>
<tr><td>Post-Harvest Processing (early processing)</td><td><u>Glume wheat</u>
threshing , raking, 1st and 2nd winnowing, parching, pounding, coarse and fine-sieving</td><td><u>Free-threshing wheat</u>
threshing , raking, winnowing, coarse and fine-sieving</td><td>chipped stone, wooden poles, basketry (sieves), mortars</td><td><u>Glume wheat</u>
threshing → spikelets, awn fragments
raking → spikelets, awns, culm bases, weed seeds
winnowing→ grain, heavy straw nodes, rachis fragments, spikelets, most weed seeds (light and small) (residuals used for fuel, fodder, temper)
Coarse-sieving→ prime grain, heavy weeds, spikelet forks
fine-sieving→ prime grain, some weeds similar in size, and rare rachis fragments (tail grain and small weed seeds and heavy chaff used for animal feed and famine foods)</td><td><u>Free-threshing wheat</u>
threshing → grain and light chaff fall free, rachis segments
raking→ free-grain, fine chaff, rachises, weed seeds (waste straw for fuel fodder and temper)
winnowing→ grain, heavy straw nodes, rachis fragments, spikelets, most weed seeds (light and small) (residuals used for fuel, fodder, temper)
Coarse-sieving → heavy weeds, grains, spikelets
fine-sieving → prime grain, some weeds similar in size, and rare rachis fragments</td></tr>
<tr><td>Distribution</td><td colspan="2">storing and allocation</td><td>storage vessels, silos, pits, bins</td><td colspan="2">Cleaned or semi-cleaned grains including weed seeds</td></tr>
<tr><td>Preparation (late processing)</td><td colspan="2">grinding
baking</td><td>hearths, ovens ground stone (e.g. mortars, querns), cooking vessels</td><td colspan="2">grains
similarly-sized weed seeds, with a predominance of larger weeds over small weed seeds</td></tr>
<tr><td>Consumption</td><td colspan="2">eating/drinking</td><td>pottery, stone bowls, and platters</td><td colspan="2">rarely preserved food remains</td></tr>
<tr><td>Disposal</td><td colspan="2">clearing up</td><td>preparation waste</td><td colspan="2"></td></tr>
</table>

Chapter 2

Environmental and Archaeological Background of Cyprus and the mainland Levant

2.1 Introduction

This chapter includes a discussion of both the environmental and archaeological context of this research. First, an examination of the study area will be presented including a short discussion of the topography, geology, climate, and vegetation of Cyprus and a more detailed summary of the current and past vegetation of the areas from which new archaeobotanical data is analysed in this thesis. Given that this research looks at chronological and regional change in the economy of prehistoric Cyprus it is important to situate the island within its broader regional context. The second section of this chapter outlines the archaeological background of this research and includes a summary of the archaeological complexes of Cyprus and the Levantine mainland dated to the Aceramic Neolithic, Ceramic Neolithic, Chalcolithic, and Early and Middle Bronze Age. However, the primary focus of this research is Cyprus and accordingly the cultural background of contemporary mainland traditions will be discussed only in more general terms.

2.2 Cyprus, the study area

2.2.1 Topography and Geology

Cyprus is situated in the eastern Mediterranean about 105 km west of Syria and 65 km south of Turkey. It is located between 34°33' - 35°41' N/32°17' - 34°35' E. The island is the third largest in the Mediterranean, third to Sicily and Sardinia, with an area of about 9251 square km (Christodoulou 1959). Christodoulou (1959) separated the island into nine topographically defined regions and more recently Zohary (1973) and Meikle (1977) collated them into four: 1) The Coastal Belt; 2) The Kyrenia or Northern Range; 3) The Troödos or Southern Range; and 4) The interior lowland Mesaoria or Central Plain (Meikle 1977, 1-3). This discussion is structured according to the four classifications outlined by Zohary (1973) and Meikle (1977) with the inclusion of the sub-regions discussed by Christodoulou (**Figure 2.1**).

The coastal belt consists of fertile, tilled land as well as uncultivated land and is divided into the following sub-regions: the Larnaca Region, the Polis Lowlands, the Ktima Lowlands, the Limassol Lowlands, and the Chalk Plateaus of the south, with the Larnaca region further divided into the upland and lowland areas. The upland area includes portions of the lower Troödos Massif and the pillow-lava hills and the lowland region consists of raised beaches and sand dune formations (Christodoulou 1959). The coastal belt is low-lying and is characterized by mostly rocky or stony shores with some sandy bays and salt-flats (Meikle 1977).

Figure 2.1 Map of Cyprus showing geology and topography (modified from http://mapsof.net/map/cyprus-topo-map)

There are three Chalk Plateaus located in the south of Cyprus, named the Paphos, Limassol, and Lefkara Plateaus. The Polis Lowlands is within the Chalk Plateaus but Christodoulou (1959) distinguishes based on morphology, which includes raised beaches, sand-dunes in the eastern portion, a gorge, and numerous river terraces. The Ktima Lowlands measure ca. 11 miles wide and runs ca. 26 km along the southwest coast from the villages of Kissonerga to Kouklia. The Limassol Lowlands include the Akrotiri peninsula in the southern portion, the delta of the Kouris River in the north-west, and living sand-dunes in the northeast coast.

The Northern or Kyrenia Range is an alpine mountain range that measures ca. 80 km long and runs parallel and near to the island’s northern coast (Meikle 1977;

Christodoulou 1959). The land is mostly uncultivated and the only cultivated areas are located in the upper valleys. Christodoulou (1959) states that the peninsula is a continuation of the Kyrenia mountain range but the folding is much less severe and thus, the peninsula is separated from the mountain range based on morphology. He describes the region as "one of beveled ridges, flat-topped plateaus, wide basins or valleys, steep banks the result of undermined limestone capping" (Christodoulou 1959, 10).

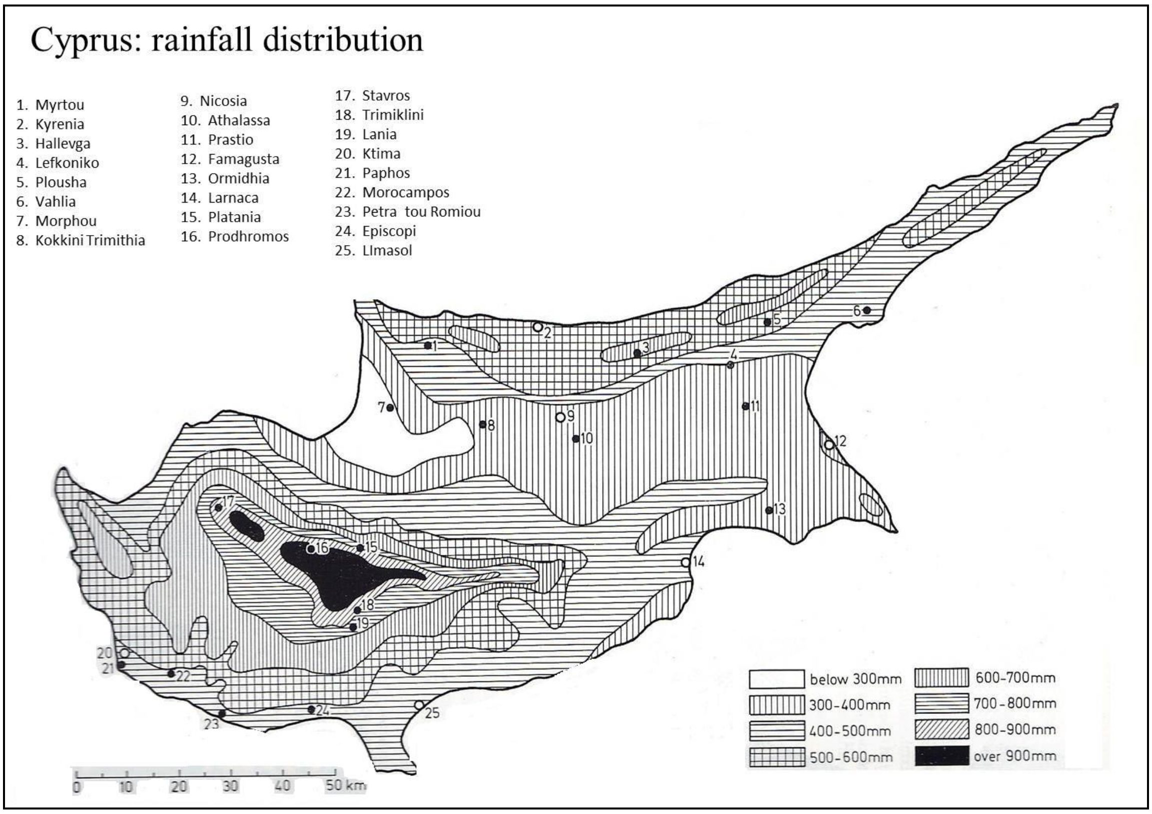
The Troödos mountain range is part of an old mountain system that is in alignment with the African Rift Valley system and is the most defining geological feature of Cyprus, encompassing the central igneous mass and covering much of the southwest of the island (Christodoulou 1959; Meikle 1977). Most of the mountain range lies above 1200 meters in elevation and the highest point of the island is Mt. Olympus at about 1950 meters elevation (Meikle 1977). The higher elevation comprises igneous rock of dolomite (i.e. igneous dolerites and gabbros), which is surrounded by pillow lavas in the lower elevations; the pillow lavas surround the Massif but cluster primarily in the NE (Christodoulou 1959; Constantinou 1982). The pillow lavas are also found in small outcrops elsewhere on the island (Christodoulou 1959) and are the main source of two important resources exploited in Cypriot prehistory, namely copper and picrolite (Peltenburg 1982b; Steel 2004).

The Mesaoria or Central Plain runs about 90 km west to east and is 56 km wide in the east and 29 km in the west (Christodoulou 1959; Meikle 1977). It separates the Kyrenia and Troödos mountain ranges (Meikle 1977). Christodoulou (1959) argues that the region should be considered the Central Lowlands as opposed to the Central or Mesaoria Plain because it is technically not a plain and the region is not exclusively between the mountains as the term "Mesaoria" implies (i.e. two-thirds of the region lie east of the point at which the Troödos mountain range recedes) (Christodoulou 1959). This region is for the most part tree-less but fertile with cereal fields, traversed by seasonal rivers that are dry in the summer months (Meikle 1977).

2.2.2 Present Climate

Cyprus has an arid Mediterranean climate with short, cool and wet winters and long, dry and hot summers. The annual rainfall ranges from 250 mm to 1270 mm per year, with an island-wide average of approximately 500 mm (Christodoulou 1959; Meikle 1977). Regional variations in both temperature and rainfall are a result of differences in elevation, topography, and season (Christodoulou 1959; see also Meikle 1977, 1-3). Most of the rainfall occurs at higher elevations between October and March. At the topmost slopes of Mt. Olympus the average annual rainfall is approximately 1000 mm compared to less than 254 mm in areas of the western Mesaoria (Michaelides *et al.* 2009) (**Figure 2.2)**.

Figure 2.2 Map of Cyprus showing modern average rainfall distribution (Zohary 1973, 29)



In regards to the island’s seasonal rainfall Christodoulou (1959, 21) states the winter rainfall is probably the most significant aspect of the island’s environment. Winter receives the greatest amount of rain in the year and it is both beneficial and effective because it occurs when temperatures are lower, lessening the amount of moisture lost by evaporation. Accordingly, summer rainfall would be much less effective and even damaging, causing floods, soil erosion, crop damage, and higher malaria rates due to the fact that mosquitos could breed in areas of standing water (Christodoulou 1959). There is variability in annual rainfall year to year and prolonged droughts on the island are not infrequent and can last decades (Meikle 1977, 1-3). Christodoulou (1959) emphasizes the effect of drought on the island's land-use patterns and people. Recurrent droughts have been influential in the stability of the island's economy in the recent past and, no doubt, also in prehistory. During drought, crops may fail, springs and wells may dry up, livestock may diminish, and settlement relocation may result. Variability in temperature is minimal from year to year but varies significantly according to elevation and topography, with the hottest summer temperatures occurring in the Central Lowlands and the coolest in the highest elevations in the Troödos mountains (Christodoulou 1959).

2.2.3 Vegetation

Meikle (1977, 4-8) divides the island into eight phytogeographic zones (Divisions 1-8) which are covered by six general vegetation groups; pine forests (i.e. *Pinus brutia* and *Pinus nigra*), garigue (or the more dense, maquis), rocky areas, coastal areas, wetlands, and cultivated land (**Figure 2.3**) (Tsinides 1998, 11-20). More specifically, Zohary (1973, 151) describes the vegetation of Cyprus as a classic Mediterranean phytogeographical region and discusses five general vegetation classes: 1) the Quercetalia calliprini (i.e. Quercetalia and Sarcopoterietalia), 2) the Quercetea cerris orientalia, 3) Cedretea, 4) the central plain, and 5) the narrow alpine zone of the Troödos Mountains (Zohary 1973, 153). With the exceptions of the Quercetea calliprini and the central plain, all categories are located above 900 meters elevation and have, to date, little evidence for human occupation in prehistory. As a result this discussion will focus primarily on the Quercetea calliprini since it is this class that best describes the present vegetation of the location of the four sites with new botanical material analysed in this thesis, which are located in the coastal belt of the island's southwest (Division 1) below 400 meters in elevation.

Following Meikle (1977, 4), a large portion of the island was likely forested in antiquity, and with the exception of agricultural land, is the main vegetation cover of the island today. The only area that is not covered by pine forest is in the Mesaoria plain towards Morphou (Tsinides 1998). The Troödos mountain range (Division 2) is the most significant geographical feature of the island, with an elevation mostly above 1200 meters. Although forest cover has likely receded since the Neolithic, Chalcolithic, and Bronze Age occupations due to deforestation, there is still a large part of this region covered by golden oak and cedar (*Quercus alnifolia* and *Cedrus libani* ssp. *brevifolia*, respectively) and in the lower slopes, pine forest (Meikle 1977, 4). The latter of which was likely to have covered the prehistoric landscape around Krittou Marottou-'*Ais Yiorkis*, Prastion-*Mesorotsos*, Souskiou-*Laona*, and Kissonerga-*Skalia*. In her report on the wood charcoal macro-remains from Neolithic and Chalcolithic occupations at Kissonerga-*Mosphilia*, Asouti (1998, 74-76) characterised the prehistoric landscape as typical maquis-type Mediterranean dense woodland/forest vegetation with a range of evergreen and deciduous oak taxa including oak (*Quercus* sp.), lentisk (*Pistacia* sp.), wild carob (*Ceratonia* sp.), fig (*Ficus* sp.), pine (*Pinus* sp.), and olive (*Olea* sp.). However, today modern-day villages and agricultural land are the dominant features surrounding these sites, with the presence of cultivated cereal fields, fallow fields, vineyards, and citrus and banana groves.

The current vegetation of the areas surroundings these sites is primarily the evergreen maquis and forests of Quercetea calliprini (i.e. the Quercetalia and Sarcopoterietalia), which extends from sea level to about 1200 meters elevation and comprises maquis, batha, and garigue plant communities. This oak-type maquis vegetation of tall shrubs (4-6 meters) includes the species *Phillyrea media* (broad-leaved phillyrea), *Styrax offinalis* (styrax), *Olea europaea* (olive), *Arbutus andrachne* (Greek strawberry tree), *Pistacia terebinthus* (terebinth), *Laurus nobilis* (laurel), *Quercus coccifer* (kermes oak), and *Rhamnus alaternus* (Mediterranean buckthorn) (Meikle 1977, 4; Zohary 1973, 153-155). The Quercetalia class comprises Ceratonieto-Pistacietum lentisci, *Quercus calliprinos-Pistacia palaestina* maquis, and Pinetum brutiae (Zohary 1973, 153). The Ceratonieto-Pistacietum lentisci, or carob-lentisk community, covers the dry and lower zones of the island and extends in elevation to about 300 meters. As the name suggests, the carob tree (*Ceratonia siliqua*) and lentisk (*Pistacia lentiscus*) are the principal components of this vegetation.

The deforested and heavily grazed maquis landscape has developed into the Sarcopoterietalia class of Quercetea calliprini, which comprises batha and garigue communities of *Sarcopoterium spinosum* (pricky burnet), *Coridothymus capitatus* (conehead thyme), *Calycotome spinosa* (spiny broom), *Lavandula stochas* (lavender), and *Cistus* spp. (rockrose) (Zohary 1973, 153). These areas are more common and are covered by the less dense, garigue communities of low (< 3 meters) shrubs including, rockrose, *Genista sphacelata*, *Calycotome villosa*, gromwell (*Lithospermum* spp.), and mastic tree (*Pistacia lentiscus*) (Meikle 1977, 4). Further, where animal grazing is even more intensive the garigue vegetation is reduced to batha, which includes the following species: thorny burnet, needle sunrose (*Fumana arabica*), *Micromeria* spp., *Teucrium polium* (felty germander), *Rhamnus oleoides* (mediterranean buckthorn), *Salvia* spp. (sage), *Lavandula stochas*, *Genista fasellate*, and thymus (*Thymus capitatus*) (Meikle 1977, 4; Zohary 1973, 154). Additionally, there are aquatic plant communities near rivers and springs, which are common throughout the coastal belt and near to the aforementioned sites. For example, there is a spring less than 300 meters south of Krittou Marottou-'*Ais Yiorkis* and the Ezousas River is located only 1 km from the site, and both Souskiou-*Laona* and Prastion-*Mesorotsos* are located in the Dhiarizos River Valley. It is near these river banks and springs that aquatic plant communities of the Phragmitetea and Potamotea classes persist today and also likely to have been present in the past. The Phragmitetea class is dominated by Phragmites and sedges (Cyperaceae) including *Phragmites australis, Cyperus* spp., *Eleocharis palustris,* and *Carex* spp. The Potamotea (pondweed class) can be found near river banks and is dominated by aquatic species including *Potamogeton* sp., *Tamaricetum pentandrae*, *Alnetum orientalis*, *Platanetum orientalis*, and *Salicetum albae* (Meikle 1977; Zohary 1973, 153-154).

Figure 2.3 Map of Cyprus showing phytogeographic zones (Meikle 1977)

2.2.4 Paleoenvironment of the Near East and Cyprus

> "…the conventional wisdom that the increases in social complexity associated with the development of agriculture, large settled communities and the earliest states were made possible by relatively stable, benign climatic conditions during the Holocene can no longer be upheld… It therefore appears increasingly likely that the astonishing increases in the level of human social complexity documented in the archaeological record since the beginnings of sedentism in the late Pleistocene were accompanied by profound and recurrent climatic and environmental challenges." (Wasse 2007, 46-47 citing Brooks 2006, 26)

With regards to the island's early prehistory, it is important to situate the archaeological evidence for increasing social complexity in an environmental framework (following Wasse 2007). There are multiple lines of evidence used in the reconstruction of paleoenvironments, specifically proxy data that provide inferential evidence for climate change. In addition to bio-archaeological data (i.e. archaeobotany, zooarchaeology, human osteology), other sources can be used to infer climatic conditions, including glaciological/ice cores (i.e. oxygen and hydrogen isotopes), geological (i.e. marine core sediments, microfossils, oxygen isotopes), terrestrial (i.e. landforms and deposits), biological (i.e. tree-rings, pollen, plant macrofossils, vertebrate and invertebrate fossils), and historical climate records (Roberts 1998; Rosen 2007, 17-18; Wasse 2007). There are limited available data for early Holocene environmental reconstruction of Cyprus (Stanley-Price 1980, 1) and these data are restricted to extrapolations from the present environment of Cyprus and from paleoenvironmental research in adjacent countries on the mainland (Stanley-Price 1980; Wasse 2007). Rosen (2007, 17-31) provides a comprehensive summary of the common methods used in the reconstruction of the Near Eastern Late Pleistocene and Holocene climate, including historical records, pollen analysis, isotope analysis and geomorphology. Syntheses of these numerous lines of evidence have been provided by Baruch and Bottema (1999), Goring-Morris and Belfer-Cohen (1997), Hillman (1996), Robinson *et al.* (2006), Zohary (1973) and for Cyprus, Wasse (2007).

The climate of both the Late Pleistocene and the Holocene is characterized by fluctuating glacial and interglacial episodes and periods of moist climate and severe drought and it is within the fluctuating environmental context that significant cultural changes occurred. There are three time periods from the Late Pleistocene to the Late Holocene where climate is argued to have had an impact on the cultural traditions of the mainland Levant, the Terminal Pleistocene (i.e. Younger Dryas, hereafter YD), the Mid-Holocene, and the Late Holocene (Rosen 2007). However, recent research by Maher *et al*. (2011) discusses the lack of sound evidence in support of climatic events as the trigger for cultural change. They argue that the relationship between climatic instability and cultural change (i.e. changes in subsistence, social organization, and technology) is more complex than a cause and effect model (Maher *et al.* 2011). They do not discount that cultural change occurred in climatic instability only that is was not the direct cause. With regards to Cyprus, Wasse (2007, 48) states that there is little reason to accept that the island would not have experienced recurrent climatic fluctuations and that the Cypriot cultural tradition developed within this dynamic environmental context.

The Terminal or Late Pleistocene is characterised by a warming trend after the Last Glacial Maximum (hereafter, LGM), which includes a combination of higher temperatures and humid conditions of the Bølling-Allerød (15-13.0 cal. k BP). Following this period is the YD (12.7-11.5 k cal. BP)**,** which was a return to more cold and dry conditions that lasted about a millennium. Subsequent to the YD was a return to moister and warmer conditions at the Pleistocene - Holocene transition (Rosen 2007; Robinson *et al.* 2006; Moore *et al.* 2000). It is at the close of the YD that Levantine exploration to the island of Cyprus began, with the first evidence of human activity at Akrotiri (discussed below). The YD is considered to be a possible catalyst for the transition from a subsistence based on hunting and gathering of wild resources to the cultivation of domesticated plants and animals (Bar-Yosef 1998, Moore and Hillman 1992; also see Colledge and Conolly 2011). The subsequent Early Holocene (9500-5500 cal. BC) is a period of more moist and warm climatic conditions and it is during this time that a there were changes in human culture, including the origins and spread of the first agricultural villages (Rosen 2007). At ca. 6000 cal. BC, during the Mid-Holocene, there was an increase in dry periods and it is at this time that the first complex societies in the Near East developed. Rosen (2007, 7) states that even in these moist periods, periodic drought was a threat and restrictive element that affected cultural development. This is also the case for Cyprus in the most recent past and has been noted by Christodoulou (1959). He highlights the impact of recurrent drought on the island's communities and states the instability of rainfall from year to year not only has an effect on the psyche of the Cypriot peoples but it has an effect on settlement patterns and distribution with relocation of communities a common result. The Late Holocene climatic amelioration at ca. 4000 cal. BC is characterized by a return to more favorable climatic conditions and from about this time period onward there was great population growth, the rise of empire states, an increase in agricultural intensification, and the cash crop market economy (Rosen 2007), all of which there is archaeological evidence for in Cyprus and discussed below.

2.3 Archaeological complexes of Cyprus and the mainland Levant

2.3.1 Chronology

This research covers the duration of the Aceramic Neolithic, Ceramic Neolithic, Chalcolithic, Early and Middle Bronze Age (i.e. Early and Middle Cypriot) cultural entities of Cyprus. The Late Bronze Age (i.e. Late Cypriot) botanical material will be discussed briefly for comparison and to highlight the Middle Cypriot period as the end of small-scale, pre-urban Cyprus. Based on relative and absolute chronologies, the cultural entities of Cyprus have been subdivided into the Akrotiri, Aceramic Neolithic, Ceramic Neolithic, Chalcolithic and Bronze Age (**Table 2.1,** refer to **Figure 2.4** for site locations). All radiocarbon dates presented here are calibrated unless otherwise discussed. The Aceramic Neolithic is further subdivided into the recently defined Cypro-Pre-Pottery Neolithic A (hereafter Cypro-PPNA), the Cypro-Early Pre-Pottery Neolithic B (hereafter Cypro-EPPNB), Cypro-Middle Pre-Pottery Neolithic B (hereafter Cypro-MPPNB), Cypro-Late Pre-Pottery Neolithic B (hereafter the Cypro-LPPNB) and the Khirokitian (Peltenburg 2003; Clarke *et al.* 2007). The Ceramic Neolithic follows a gap in archaeological evidence from about 5300 to 4750 BC and spans the period *c.* 4750 to 3900 BC (Clarke *et al.* 2007). Based on excavations at Chalcolithic Kissonerga-*Mosphilia*, Peltenburg *et al*. (1998) have subdivided the Chalcolithic into an Early (Kissonerga-*Mosphilia* Period 2), Middle (Kissonerga-*Mosphilia* Period 3) and Late (Kissonerga-*Mosphilia* Period 4) occupation. The Bronze Age is subdivided into a Philia phase, an Early Cypriot I-III, and a Middle Cypriot I-III phase (Frankel and Webb 2006). Presented here is a summary of the major themes of the archaeological complexes along with a brief overview of the material culture including artefacts associated with the processing of food (i.e. pestles, mortars, and querns) and those that have been used to infer external contact and interaction with the mainland. The archaeological complexes of the mainland Levant are summarised under their chronologically contemporary Cypriot cultural traditions, “which bear only the smallest relation to chronological and cultural periodizations on the mainland” (Clarke 2007, 9). Further, as Clarke (2007, 9) highlights, there are inconsistencies in local and regional chronologies and cultural sequences across the eastern Mediterranean region and these have enforced researchers to study regions in isolation. In consideration of this, I have kept the summary of the mainland archaeological complexes brief, highlighting the main differences between the cultural traditions of the island and the mainland in an attempt to discuss significant events within the broader interaction sphere over the course of Cypriot cultural developments.

Figure 2.4 Map of Cyprus showing the sites analysed in this thesis and the sites mentioned in text (modified from Google Earth 2012)

*Table 2.1 Approximate chronological phasing for periods in Cypriot prehistory covered in this research (Peltenburg et al. 2000; 2003; McCartney 2004; Clarke et al. 2007; Knapp 2008; Simmons 1999; Frankel and Webb 2006; Steel 2004; Manning et al. 2010) (** denotes climatic event discussed in text)*

cal. BC	date cal. BC	Cultural Phase	Cypriot Assemblage
YD ** (12700-11500)			
10000			
	9825	Akrotiri	Akrotiri-*Aetokremnos*
	8800-8630	Cypro-PPNA	Agia Varvara-*Asprokremmos*
8000			
	8500-7500	Cypro-EPPNB Cypro-MPPNB	Kissonerga-*Mylouthkia* 1A Kalavasos-*Tenta* Period 5 Parekklisha-*Shillourokambos* A/B
	7500-7000	Cypro-LPPNB	Kissonerga-*Mylouthkia* 1B Kalavasos-*Tenta* Periods 4-2 Parekklisha-*Shillourokambos* Middle Krittou Marottou-*'Ais Yiorkis*
6000 **	7,000-5,200	Late Cypriot Aceramic (Khirokitian)	*Tenta* Period 1, Khirokitia, , *Mosphilia* 1A, Cape Andreas-*Kastros*, Kholetria-*Ortos*
	5300-4750	GAP	GAP
	4700-3900	Late Neolithic	Dhali-*Agridhi*, Sotira, *Vrysi*
4000	3900-3500	Early Chalcolithic	*Mosphilia* Period 2
		Middle Chalcolithic	*Mosphilia* 3A-3B
	2700-2500	Late Chalcolithic	*Mosphilia* 4
	2500-2200	Early Cypriot-Philia (Knapp PreBA 1)	Kissonerga-*Mosphilia* 5 (poorly defined) Marki-*Alonia* (Phase A, B)
2000 **	2300-2000	Early Cypriot I- EC II (Knapp PreBA 1)	Marki-*Alonia* (Phase D, C)
	2100-1900	Early Cypriot III	Marki-*Alonia* (Phase F, E) Sotira-*Kaminoudhia*
	2000-1700	Middle Cypriot I-II (MCII 1850-1750) (MCIII 1750-1675/1650	MCI, Marki-*Alonia* (Phase H, G) MCII, Marki-*Alonia* (Phase I) Episkopi-*Phaneromeni* (Area G, C, and J)

2.3.2 Akrotiri Phase of Cyprus and the Natufian of the mainland Levant

2.3.2.1 The Natufian of the mainland Levant

The earliest recorded island travelers were part of a mainland Levantine cultural complex known as the Natufian (ca. 12500-9500 cal. BC). The Natufian is divided into three phases, an Early, Late and Final Phase and is thought to be the link between hunter-gatherers and the first farmers (Rosen 2007) and is what Bar-Yosef (2011) has described as the "point of no return" **(**Bar-Yosef and Belfer-Cohen 1989; Belfer-Cohen and Bar-Yosef 2000), meaning it was the point at which hunter-gatherers continued on the path to a farming lifestyle. It is composed of semi-sedentary small villages, with evidence for storage based on the presence of commensal animals (i.e. house mouse) (Tchernov 1991; Bar-Yosef 2011). Evidence for human occupation includes circular pit-houses with stone foundations and external secondary burials, with evidence for decorated human skeletal remains (Bar-Yosef 2011). Material culture includes artefacts interpreted as symbolic representations, ground stone, including pounding tools (mortars, bedrock mortars, robust pestles) and milling and grinding tools associated with the processing of plant material (handstones, grinding slabs) (Wright 2000), microlithic chipped-stone assemblage, including cores, bladelets, flakes, sickle blades, with evidence of hide working from the chipped stone tools, basketry, and bone hooks (i.e. for fishing). The Natufian subsistence consisted of animal hunting (gazelle and small animals including hares, tortoise, gazelles, fallow deer, roe deer, and fish) and the exploitation of wild cereals (Bar-Yosef 2001; Kislev *et al.* 1992).

2.3.2.2 Akrotiri Phase of Cyprus

The Akrotiri Phase is the earliest phase of human activity discovered on Cyprus and is described as an exploratory period when the island was visited repeatedly by transitory hunter-gatherers (Peltenburg *et al.* 2001, 62; see also Broodbank 2006, 209) in the early tenth millennium BC (Simmons 2004). Akrotiri-*Aetokremnos*, or Vulture Cliff, lies on the southern coast of the island on the Royal Air Force Base (Akrotiri peninsula) and is the site after which the cultural phase is named. The site is thought to have been a short-term occupation and 31 radiocarbon determinations place the occupation around 9825 BC (Simmons 1999). The chipped stone industry, which comprises thumbnail scrapers, burins, retouched blades, bladelets and flakes, parallels Levantine Epipalaeolithic and early Neolithic assemblages (Simmons 2004), particularly the chipped stone from

Öküzini in Antalya (Bar-Yosef 2001, 37). In addition to the pygmy hippopotamus, the faunal assemblage also includes dwarf elephants, deer, pig, genets, mice, birds and marine invertebrates. Other material culture includes stone and shell beads. Of note is that in contrast to subsequent cultural phases no obsidian has been reported on the island at this time (Simmons 2004).

Additionally, stone tools and hearths have been found in association with faunal remains of the indigenous pygmy hippopotamus, *Phanourios minutus* (Simmons 1999). Simmons argues that humans played an active part in the extinction of the fauna (Simmons 2001) and for this, association between the archaeological and the faunal data are controversial. Others have questioned the links between the humans and the pygmy hippos, specifically whether humans were responsible for the killing of the hippos at the site (Ammerman and Noller 2005). Regardless of whether or not humans played a part in the extinction of this fauna at Akrotiri-*Aetokremnos*, the data from the site fueled discourse and further inquiry into an earlier phase of human occupation than the previously held Khirokitian (Ammerman and Noller 2005; Simmons and Mandel 2007). Ammerman and colleagues have undertaken surveys with the specific intention of demonstrating that Akrotiri-*Aetokremnos* is not the only site that represents the earliest phase of human activity on the island (Ammerman *et al.* 2006; 2008). Investigations of coastal sites located in the Akamas in the west and near Agia Napa in the east; these sites lie beneath hardened sand dunes and have provided evidence of a flake-based technology with the reduction of chert pebbles and small blades (Ammerman *et al.* 2008). The first radiocarbon dates from Nissi Beach place the site in the Cypro-MPPNB, which has been argued to be the result of inversion of cultural deposits caused by the sea. Despite evidence to the contrary, Ammerman *et al.* (2008) argue the lithic assemblages at Nissi Beach, Aspros and Alimman parallel mainland Natufian small flake and blade assemblages.

2.3.3 Pre-Pottery Neolithic A of Cyprus and the mainland Levant

2.3.3.1 Pre-Pottery Neolithic A of the mainland Levant

The PPNA on the mainland has the first undisputed evidence for village settlements and the cultivation of cereals (Colledge 1998, Hillman and Davis 1990). Bar-Yosef (2001) describes the PPNA as a non-egalitarian agricultural society with hunting and gathering.

Sites dated to the PPNA in the Jordan Valley include Jericho, Netiv Hagdud, Iraq ed-Dubb, Wadi Feinan and Nahel Oren, and Jerf el Ahmar and Mureybet II in the Middle Euphrates (Bar-Yosef 2001). The architecture of the mainland PPNA is comparable throughout the region, comprising circular unbaked mud-brick pit-houses with stone foundations typically measuring about 10-20 feet in diameter (Bar-Yosef 2001; Rollefson 2003). The ground stone assemblage includes shallow grinding bowls, hand stones, mortars, and pounding tools (Bar-Yosef 2001). At this time there is a greater occurrence of a burial practice in which the skull is separated from the body (Rollefson 2003). In particular, the Sultanian Industry has evidence of this practice with single burials with no grave goods with the skulls recovered from domestic areas (Bar-Yosef 2001). Symbolic representations come in the form of limestone or clay anthropomorphic figurines interpreted possibly as females standing or kneeling (Bar-Yosef 2001). Evidence for long distance trade during the PPNA comes from obsidian imported from central Anatolia and marine shells from the Red Sea (Bar-Yosef 2001). During this time there is evidence of wild cereal and pulse cultivation (Colledge 1998; Willcox *et al.* 2008; Willcox 2011) accompanied by the hunting of gazelle, equids, and cattle in the middle Euphrates and gazelle, fox, fallow deer, wild boar, and wild cattle in the Jordon Valley (Bar-Yosef 2001).

2.3.3.2 Pre-Pottery Neolithic A of Cyprus

The Cypro-PPNA (Manning *et al*. 2010; McCartney 2005; McCartney *et al*. 2007) represents the first migration of semi-permanent complex foragers from the mainland Levant to Cyprus. The migration involved mainland Late PPNA groups and possibly with inhabitants of sites dated to the earliest PPNB levels on the Euphrates (Manning *et al.* 2010). The Cypriot PPNA coincides with more warm and humid conditions characteristic of the beginning of the Holocene (Rosen 2007) and thus, climatic conditions possibly made Cyprus more attractive (Manning *et al.* 2010).

Agia Varvara-*Asprokremmos* is one of a handful of sites that have been recently surveyed and excavated by the Elaborating Early Neolithic Cyprus (hereafter EENC) project (directed by Carole McCartney and Sturt Manning). The aim of this project is to explore the whereabouts of presumed early hunter-gatherer sites that have been unrepresented due to past survey and excavation biases that have focused on single excavations of large sites, as opposed to small artifact scatters (McCartney *et al.* 2006). The project has surveyed eleven sites near the modern villages of Pera Chorio (i.e. Agia Varvara, Politiko, Analiondas, and Alampra). Excavations at Agia Varvara-*Asprokremmos* have provided evidence for PPNA occupation on the island filling the previous gap in occupation between the Akrotiri Phase and the Cypro-EPPNB. Subsequently, the evidence has embedded Cyprus in the mainland PPNA interaction sphere with parallels in material culture (Manning *et al.* 2010). The site includes evidence of refuse in natural hollows (i.e. pits) and a simple semi-subterranean pit shelter with a posthole. The material culture recorded at the site includes picrolite pendants and beads, dentalium shell beads, ground stone artefacts, stone vessels (i.e. flat based 'trays', hemispherical bowls, one ochre-painted), two ground stone shaft-straighteners (parallels PPNA Jerf el Ahmar), and a fragment of a baked clay anthropomorphic figurine (Manning *et al.* 2010). Evidence from the chipped-stone assemblage includes microliths, bifacially backed blades, over 100 arrowheads, an absence of naviform core technology and a presence of unidirectional lithic core reduction similar to sites dated to the late PPNA/EPPNB in the northern Levant (McCartney *et al.* 2006; Manning *et al.* 2010). Similar to the preceding Akrotiri phase, there is evidence of wild pig management and the exploitation of fish and fresh water crab (Manning *et al.* 2010). Manning *et al.* (2010, 703) state that although the island did not participate in the earliest obsidian trade networks, evidence from the site is suggestive of an interaction extending from the Euphrates to the southern Levant (Manning *et al.* 2010, 703). Additionally, recent excavations at Ayios Tychonas-*Klimonas* provide evidence that further establishes the presence of a PPNA on Cyprus. Ayios Tychonas-*Klimonas* is located on the other side of the Troödos mountain range from the EENC sites and the architecture includes a communal 10m circular subterranean structure with multiple hearths and post-holes and several circular domestic structures (Vigne *et al*. 2011b; Vigne *et al*. 2012). Faunal remains so far demonstrate the exploitation of wild boar, the presence of domesticated cats and dogs, and evidence of commensals, suggesting possible storage. The chipped stone assemblage includes burins, scrapers, drills, glossed sickle blades, and stone shaft-straighteners. Evidence of PPNA sites with parallels in material culture and architecture to the mainland demonstrates connection and interaction between the two prior to the Cypro-PPNB.

2.3.4 Pre-Pottery Neolithic B of the mainland Levant and Cyprus

2.3.4.1 Pre-Pottery Neolithic B of the mainland Levant

Multiple significant cultural changes occurred during the PPNB on the mainland, including changes in architecture, technology, burial practices, and trade, which were accompanied by population increase, expansion and, of course, population movement. The PPNB of the mainland Levant is divided into four phases, Early, Middle, Late, and Final. The PPNB emerges in the Northern Levant and it subsequently spread to other regions (Bar-Yosef 2001). Sites dated to the PPNB and that are located in the northern Levant include Jerf al-Ahmar (Stordeur 2003), Mureybet (Cauvin 2000), Çayönü (Özdoğan 1999), and Nevali Çori (Hauptmann 1999) and sites that are located in the southern Levant include Jericho (Kenyon and Holland 1982) and 'Ain Ghazal (Rollefson 1993).

There is a change in domestic architecture from the proceeding mainland PPNA, including a change from curvilinear domestic structures to rectangular buildings with multiple lime-stone plastered floors (Bar-Yosef 2001; Rollefson 2003). The chipped-stone industry comprises arrowheads and sickle blades that were constructed on the bi-directional naviform core technique (Bar-Yosef 2001; Rollefson 2003). Human burial practices during the PPNB are suggestive of social hierarchy with a dichotomy in the treatment of the dead. For example, intact bodies have been found apparently discarded in secondary deposits. Further, in the Levant the decapitated skulls were treated with plaster and pigment, in particular at 'Ain Ghazal (Rollefson 1993). In the MPPNB there appears to be a greater representation of wild cattle figurines and human representations representing female fertility (Rollefson 2003).

2.3.4.2 Pre-Pottery Neolithic B of Cyprus

It is during the PPNB that farming communities spread from the mainland to other regions including Cyprus. In regards to the spread of the PPNB Finlayson (2004, 19-20) states that at this time there are notable differences in site types, architecture, decoration, environmental location, and economies on the mainland but overall a single PPNB 'multifaceted phenomenon' is evident. Further, the evidence from early sites on Cyprus places the island in the mainstream tradition with its unique variations adapted to the local environment. The Cypro-Early PPNB provides the first evidence of a

Levantine migration of an agricultural group in the mid-late ninth millennium BC (Peltenburg *et al.* 2001; 2003; Peltenburg 2004a). Peltenburg *et al.* (2000) argue for strong analogies with the northern Levant (Peltenburg *et al.* 2000; 2001; 2003), including similarities with sites in the mid-upper Euphrates such as Jerf el Ahmar, Abu Hureyra 1 and 2, Göbekli Tepe, Halula, Çayönü, and Mureybet (Peltenburg *et al.* 2003, 95). In opposition Simmons (Simmons 2004, 11) observes parallels with the southern Levant including Jericho, ‘Ain Ghazal, Wadi Shu’eib, and Gwair I, based on the similarity of settlement types. Also, Colledge el al. (2004; see also Colledge and Conolly 2007) suggest origins in the southern Levant for the crop and weed assemblages represented in the charred macro remains found at the sites. This issue will be discussed further in Chapter 7, where multiple origins are suggested (Lucas *et al.* 2012).

Architectural features of the Cypro-EPPNB include wells, pits, and post-hole alignments. For example, at Parekklisha-*Shillourokambos* a large trapezoidal enclosure was recovered and was presumably used for keeping livestock (Guilaine and Briois 2001; Peltenburg et al. 2003). The wells at Parekklisha-*Shillourokambos* (Early Phase A) and Kissonerga-*Mylouthkia* (Period 1A) are the earliest known water-wells and have become a diagnostic feature of the early colonizing sites on the island (Peltenburg *et al.* 2001, 2003). Another characteristic of the early colonizing sites is the relatively high occurrence of imported Anatolian obsidian, which further supports external links with the mainland at this time (Peltenburg *et al.* 2003; Guilaine and Briois 2001). The chipped stone industry demonstrates the use of high quality translucent chert in the manufacture of a blade based industry of projectile points and sickles, the latter being used in the harvesting of cereals (Guilaine and Briois 2001; Peltenburg et al. 2001). The ground stone industry includes predominately stone vessel fragments and crude limestone hammer stones as well as axes, pounders, grooved stones, and mace heads (Peltenburg *et al.* 2003). The occurrence of cutting tools are rare and artifacts for food processing, including querns and rubbers, are absent from the earliest level at Kissonerga-*Mylouthkia* (Peltenburg *et al.* 2003).

The Cypro-Middle PPNB is a period of amalgamation and contact with the mainland and is followed by a development phase in the Cypro-LPPNB, which is marked by a supposed decrease in external contact (Peltenburg 2004a, 72). Cypro-MPPNB occupation is limited to Parekklisha-*Shillourokambos* (Middle) and the sites with Cypro-LPPNB occupation include Kissonerga-*Mylouthkia* (Period 1B), Kalavasos-*Tenta* (2-4), Parekklisha-*Shillourokambos* (Middle and Late), and Krittou Marottou-‘*Ais Yiorkis* (Middle/Late) (Peltenburg *et al.* 2001; Peltenburg *et al.* 2003). Architecture includes wells (Kissonerga-*Mylouthkia*), pits, circular mud-brick domestic structures, hearths (Peltenburg *et al.* 2003) and a mud-brick and stone wall enclosure at Kalavasos-*Tenta* (Todd 2001; 2003). An insular adaptation involving unidirectional core technology based on a local opaque material continues into the subsequent Khirokitian, replacing the bi-directional core reduction using high quality translucent chert (Peltenburg *et al.* 2003; Peltenburg *et al.* 2001). The ground stone assemblage consists of mace heads, pierced limestone discs, stone bowl fragments, hammer stones, hole-mouth vessels, pounders and anvils (Peltenburg *et al.* 2003). Similar to the preceding Cypro-EPPNB, cutting tools are rare and querns and rubbers are absent (Peltenburg *et al.* 2003). There are parallels in burial practices with preceding mainland traditions, particularly the practice of multiple secondary burials and post-mortem removal of the skull from the body, which is evident at Kissonerga-*Mylouthkia* (well 133) (Peltenburg *et al.* 2003). Mainland contact during this phase comes from evidence of imported south-central Anatolian (Çiftlik) obsidian (Todd 2003; Simmons 2003) and external influence is also apparent in the form of anthropogenic wall paintings, similar to those at Middle PPNB Halula and Çatal Höyük, found at Kalavasos-*Tenta* (Todd 2003; Peltenburg *et al.* 2003).

It is during the 7th millennium BC that the mainland PPNB culture is said to have collapsed (Akkermans and Schwartz 2003; Bar-Yosef 2001; Kuijt and Goring-Morris 2002; Rosen 2007, 37; also see Maher *et al.* 2011 for alternative argument). Evidence for this cultural collapse includes site abandonment and the replacement of large villages with smaller communities (Bar-Yosef 2001). However, there is evidence of population increase at some sites including Abu Hureyra, Basta, ‘Ain Ghazal, and Wadi Shu’eib (Rollefson 2003). The PPNC culture is characterized by a decrease in the use of bidirectional naviform technology, grinding stones and sickle blades, in human and animal symbolic representations, and in the ritual of skull detachment (Rollefson 2003).

2.3.4.3 Khirokitian

Le Brun (2001, 33-34) states that from the second half of the 7th millennium BC, Cyprus experienced internal cultural evolution and developed a unique Cypriot identity distinct from contemporary mainland cultural traditions and which reached full expression in the late Aceramic Neolithic, or the Khirokitian Culture. It is from this point forward that Cyprus veered from the mainland cultural trajectory not to return to it until the Bronze Age. The Khirokitian culture of Cyprus is contemporary with the mainland Pottery Neolithic and differs from mainland traditions in multiple ways, of great significance is pottery manufacture, architecture and social complexity. Whilst the mainland cultures were experimenting with unfired pottery in the Late PPNB in the northern Levant (Syria and Jordan) and hand-made fired pottery in the Pottery Neolithic (i.e. pre-Halaf and Halaf, c. 6570-5400 cal. BC) (Bar-Yosef 2001; Rollefson 2003), the distinct cultural identity of the last phase of the Aceramic Neolithic of Cyprus, the Cypriot Khirokitian (ca. 7000-5200 cal. BC), was only just emerging. Although there is evidence for experimentation with early pottery technology, including roughly made, partly fired, (perhaps cooked), clay vessels and unbaked figurines in the Cypriot Aceramic Neolithic, there is no evidence for firing technology that is required for pottery production (Clarke 2007, 11).

The Khirokitian cultural entity is considered to be the pinnacle of the Aceramic Neolithic culture in Cyprus (Peltenburg 2004b, 72). Evidence comes primarily from the largest site of the Aceramic Neolithic, Khirokitia-*Vounoi*. Other sites that have Khirokitian occupation include Dhali-*Agridhi*, Cape Andreas-*Kastros,* Kalavasos-*Tenta*, Kholetria-*Ortos* and Kissonerga-*Mosphilia*. The major archaeological feature of this phase is the thick-walled circular domestic structure, specifically the circular pillar (CPB, buildings with internal large rectilinear pillars) and circular radial buildings (CRB, buildings with no central installations and peripheral cells or partitions) (Peltenburg 2004b, 73-75). This architecture illustrates a dichotomy with the rectilinear buildings of contemporary mainland sites, which persist from this date forward. However, the circular architecture of Cyprus demonstrates parallels with the architecture of earlier mainland occupations, specifically at Late Mureybetian/PPNA Mureybet III, Jerf el Ahmar and Munhatta 3 (Peltenburg 2004b, 79).

The chipped stone of this phase has been described as rough and impoverished and lacks variation, pressure retouch, and specific tools such as arrowheads (Le Brun 2001). The ground stone industry includes stone vessels, mace heads, incised stones, batons, figurines, and axes, which it is suggested are indicative of larger scale clearance of woodland in advance of cereal crop agriculture (Peltenburg *et al.* 2003; Steel 2004). Changes in funerary practices are evident with single primary pit burials replacing the multiple secondary burials of the previous Cypro-PPNB (Peltenburg *et al.* 2003; Le Brun 2001). A decrease in the incidence of imported Anatolian obsidian suggests a decrease in contact with the mainland during this period (Le Brun 2001; Peltenburg *et al.* 2000). However, on the basis that it would have been necessary to continually re-introduce fauna to the island in order to sustain island populations, Horwitz *et al.* (2004) argue for continuous contact between the island and the mainland at this time. Additionally, McCartney and Gratuze (in Peltenburg *et al.* 2003) argue for sustained membership in the PPNB interaction sphere based on similarities in the chipped stone assemblage. Moreover, Peltenburg (2004b, 83) argues that the continued use of circular domestic architecture is an adaptive response to low population densities, the island's limited resources, and a lack of inter-group competition. Thus, the level of external contact during this time did not necessarily decrease and the differences evident between the island and the Levantine/Anatolian mainland could be a result of an insular adaptation as opposed to isolation from mainland populations.

2.3.5 Ceramic Neolithic of Cyprus and the Chalcolithic of Cyprus and the mainland Levant

2.3.5.1 Ceramic Neolithic of Cyprus

The Ceramic Neolithic of Cyprus (i.e. Sotira Culture) dates between 4700-3900 BC (Clarke 2001; Clarke *et al.* 2007) and roughly corresponds to the mainland Chalcolithic, which dates to ca. 4500-3600 (Burton and Levy 2001; Joffe and Dessel 1995). The sites dated to the proceeding Khirokitian culture are abandoned at ca. 5500 cal. BC and there is a chronological gap between the Khirokitian culture and subsequent Sotira culture. There is debate over whether the gap in the archaeological record is one of true site-abandonment or rather is a result of lowered site visibility due to increased population mobility as a result of greater emphasis on hunting (Peltenburg in Hadjisavvas 2010). The sites with Ceramic Neolithic occupation include Ayios Epiktitos-*Vrysi*, Philia, Dhali-*Agridhi*, Sotira, Kalavasos-*Tenta* and Klepini-*Troulli*, Kantou, Khirokitia-*Vounoi*, and Kokkinoyia (Peltenburg 1979b; Clarke *et al.* 2007; Clarke 2001). The architecture of this phase includes free-standing, mono-cellular, rectilinear stone and mud brick semi-subterranean structures, which include partition walls, hearths, and pisé and stone benches (Clarke *et al.* 2007; Peltenburg 1978). Changes in architecture and the organization of domestic space from the preceding phase are evident, with regularization in the arrangement of domestic fireplaces, benches and work craft activity areas (Peltenburg 1993). However, continuity from the preceding Khirokitian is demonstrated with parallels in chipped stone and ground stone assemblages (Clarke *et al.* 2007) despite the considerable time lapse between the periods. The ground stone assemblage of this period includes stone bowls, grinders, hammer stones, pestles, and mortars (Clarke *et al.* 2007; Clarke 2001, 67; Steel 2004, 63-81). The material culture of the Ceramic Neolithic is similar at all sites (Peltenburg 1993; Clarke *et al.* 2007) and includes limestone vessels, picrolite and bone ornaments, axes, adzes, chisels, and pierced discs. McCartney (in Clarke *et al.* 2007, 90) states that "given the link suggested by the engraved stone pebbles of Khirokitia-*Vounoi* and Kholetria-*Ortos* and those of Yarmoukian sites (from Byblos to Sha'ar Hagolan) it seems highly likely that Cyprus participated in this sphere of interaction, continuing this relationship with the central and southern Levant during the late Neolithic period" (citing Bar-Yosef 1992; Eirikh-Rose 2004; Garfinkel 2004).

The first evidence of pottery in Cyprus comes from three sites: Dhali-*Agridhi* in the central Mesaoria, Philia in the Morphou Bay and Klepini-*Troulli* on the north coast, and is characterized by two types: a common Coarse Ware and a Dark Burnished Ware (Clarke *et al.* 2007). The origin of the Cypriot ceramic technology is assumed to have come from the mainland since there is no evidence on the island of pyro-technology prior to the Ceramic Neolithic (Clarke *et al.* 2007). Clarke *et al.* (2007, 92) argue a mainland influence based on the following similarities: coil and slab method construction, firing techniques, the decoration of red paint, use of mats and basketry in vessel construction, the limited range of shapes, and the manufacture of coarse types. The early pottery production of Cyprus demonstrates regional homogeneity in regards to manufacturing techniques and morphology (Clarke 2007; Clarke *et al.* 2007). It was manufactured at the household level, fired in open hearths and includes the use of local clay resources in the production of simple-coil, hand-made vessels (Clarke 2007; 2001).

The ceramic types include hemispherical bowls, ovoid jugs, bottles and hole-mouth jars. Variation in decoration has been linked with regional group identity, with the northern sites expressing identity through Broad Line Red on White styles and the Southern sites with the Combed Ware styles (Peltenburg 1982c, 40; Clarke 2001). Moreover, the Broad Line Red on White from Ayios Epiktitos-*Vrysi* is a contemporary regional variant of the Combed Ware of Sotira, suggesting regionalism in the ceramic repertoire in the Middle Phases of the Ceramic Neolithic (Peltenburg, 1982, 39).

2.3.5.2 Chalcolithic of the mainland Levant

Evidence for human occupation on the island at this time is considered ephemeral. In opposition, the mainland was undergoing a 'technological' or 'specialisation revolution' (Maisels 1999). This revolution includes the establishment of temples and burial grounds, the emergence of craft specialisation, specifically an increase in the production of copper, ceramic and stone tools, and changes in the mode of interaction and trade with evidence for pack animals (i.e. donkey) (Maisels 1999; Rowan and Golden 2009). In contrast to the Ceramic Neolithic of Cyprus, contemporary Chalcolithic communities on the mainland were undergoing population increase, settlement expansion, and technological and economic developments, including aspects of the 'secondary products revolution' (discussed below) (Maisels 1999; Sherratt 1981). In addition to temples and cemeteries, there is evidence of large rectangular mud brick domestic structures with stone foundations, lime-plastered floors, and adjoining courtyards (Maisels 1999). The chipped stone assemblage includes scrapers, sickle-blades, retouched and backed blades, retouched bladelets, notches, denticulates, awls, borers, bi-faces (i.e. axes, adzes, and chisels), burins, arrowheads, and hammer stones (Levy 1986, 90). There were advances in ceramic technology, including evidence for wheel-made (i.e. slow wheel or tournette) pottery, with the inclusion of the following vessel types: v-shape bowls, large pithoi, hole mouth vessels, small globular jars, jars, bowls, basins, footed vessels, vessels with multiple handles, and churns (Levy 1986). Joffe and Dessel (1995, 514) have described the 'Late Developed Chalcolithic' (ca. 3900/3800-3700) as a period when Chalcolithic society "reaches its height of expansion, in terms of geographic extent, size and density of sites, the intensity of agropastoral production, and the complexity of procurement, production, and exchange networks." The "Late Developed Chalcolithic" corresponds with the beginning of the Cypriot Chalcolithic, discussed below.

2.3.6 Chalcolithic of Cyprus and the Early and Middle Bronze Age of the mainland Levant

2.3.6.1 The Early Bronze Age of the mainland Levant

The Cypriot Middle Chalcolithic (ca. 3500-2800 BC) is contemporary with the Early Bronze Age (ca. 3500-2000 BC) on the mainland. Although there is continuity with the earlier Chalcolithic, there were a lot of cultural and technological changes of the mainland Bronze Age culture, including the emergence of the urban state (ca. 3100 BC) accompanied by changes in domestic and funerary architecture, the use of public space, craft-specialisation (e.g. metalworking), widening international trade networks (including Egypt), and agricultural modes and technology, including the first unequivocal evidence for grape and olive cultivation, the cattle-drawn plough, and pack animals (i.e. donkeys) (Genz 2000; Richard 1987). Architecture on the mainland at this time includes urban states with paved streets, multi-room rectangular houses with courtyards and large-scale storage, centrally located temples, and fortification walls (Richard 1987). Pottery types include inverted-rim bowls, ‘teapots’, four-spouted lamps, and ledge-handled jars (Richard 1987). Metalworking included the use of copper, silver, gold, and tin for the manufacture of tools, weapons, and jewelry (Genz 2000).

2.3.6.2 Chalcolithic of Cyprus

Peltenburg states (2010, 51) that the Chalcolithic of Cyprus (i.e. Erimi culture) is characterized by significant population growth and innovations in art (e.g. symbolic representations), craft production, metallurgy and the first signs of social inequality and intensification of ritual and economy. The Chalcolithic of Cyprus dates from ca. 3900 to 2400 BC and is sub-divided into an Early, Middle and Late occupation. Many of the sites on Cyprus dated to the Sotira culture were abandoned, possibly due to climatic instability, and the Erimi culture was established due to population reorganization in the earliest phases (Peltenburg in Hadjisavvas 2010). Peltenburg *et al.* (1998) have described the Early and Middle Chalcolithic (Kissonerga-*Mosphilia* Period 4A) as pre-Anatolian contact and the Late Chalcolithic as a period of increasing external contact and subsequent development (Kissonerga-*Mosphilia* Period 4B-5). At this time continual external contact begins and the island goes from relative isolation and independence to involvement in the broader Mediterranean interaction sphere (Peltenburg *et al.* 1985). Sites with Chalcolithic occupation include Erimi-*Pamboula*, the cemeteries and settlement of the Souskiou complex, Kissonerga-*Mosphilia*, Kissonerga-*Mylouthkia*, Lemba-*Lakkous*, and Kalavasos-*Ayious* (Peltenburg *et al.* 2006; 1985; Todd 1991).

The Chalcolithic of Cyprus is marked by multiple cultural changes including new forms of domestic and funerary architecture, ideology in the form of new symbolic art, and the beginnings of copper metallurgy (Gale 1991; Peltenburg *et al.* 1985; Peltenburg 1991). Domestic architecture of this period consists of free-standing, timber-framed semi-subterranean circular pisé structures with flat roofs, stone foundations, plastered walls, centralized hearths, and partition ridges for household organization (Frankel 2005; Peltenburg *et al.* 2006; Steel 2004; Thomas 2005). The ground stone assemblage consists of axes, adzes, anvils, chisels, hammer stones, pestles, pounders, querns, stone vessels, and rubbers (Todd 1991; Peltenburg *et al.* 1985; Peltenburg *et al.* 2003; Peltenburg *et al.* 2006; Peltenburg *et al.* 1998). The pottery consists of flasks, bowls, jars, goblets, bottles, and anthropomorphic and zoomorphic vessels (Peltenburg *et al.* 2006). Cruciform picrolite figurines represent early exploitation of the island's natural resources of the mineral, which outcrops from the Kouris and Karyotis rivers. These figurines have been found in direct association with the characteristic Chalcolithic deep, bell-shaped shaft burials (Peltenburg *et al*. 2006; Xenophontos 1991). The first attempts of copper metallurgy are seen with a copper hook recovered from Kissonerga-*Mylouthkia*, a chisel tip and hook from Erimi, a chisel and possible blade from Lemba, and a snake ornament from the Souskiou-*Laona* settlement (Crewe et al. 2005; Gale 1991; Peltenburg et al. 1998; 2006).

Evidence for intense external contact in the Late Chalcolithic of Cyprus comes from the Pithos House from Kissonerga-*Mosphilia* (Period 4B). The basis for this is the evidence of new tool types, including crucibles and spindle whorls for textiles, new pottery styles, such as Red Polished jugs, large serving bowls, bulk storage vessels (i.e. pithoi), and olive oil production, all of which suggest contact with Anatolia during this time (Steel 2004; Peltenburg *et al.* 1998). There is an increase from the preceding periods in the quantity of axes and adzes, which have been used to infer greater labour investment in timber-cutting for land clearance and woodworking (Peltenburg *et al.* 1998). The cemeteries of the Middle Chalcolithic appear to be abandoned by the Late Chalcolithic, as are the associated picrolite funerary figurines. The Red on White pottery of the preceding phases (Lemba 2/Kissonerga 3B) declines and is replaced by the Red and Black Stroke-Burnished ware of the Late Chalcolithic (Peltenburg *et al.* 1998; Peltenburg *et al.* 2006). Evidence of experimentation with clays, slips, fire temperature and fire control suggests a shift from production of pottery at the household level to more specialized production (Bolger and Shiels 2003, 168). Evidence of Cypriot contact in the Late Chalcolithic off the island comes from two types of Cypriot Chalcolithic pottery recovered from Anatolian Tarsus (Frankel and Webb 2006, 104). Archaeological evidence in Cyprus of Anatolian contact comes from imported obsidian, which had been absent since Aceramic Neolithic levels.

2.3.7 Early and Middle Cypriot Bronze Age

The Bronze Age of Cyprus has been sub-divided into the following phases: Philia, Early Cypriot I-III, and Middle Cypriot I-III, with the Early Cypriot cultural complex replacing Philia sometime around 2,300 BC (Frankel and Webb 2006a, 307). This terminology and chronological schema is used here as opposed to that proposed by Knapp (2008), which places the Late Chalcolithic as Pre-Bronze Age, the Philia and Early Cypriot I-II as Pre-Bronze Age 1, and the Early Cypriot III-Middle Cypriot I-II as Pre-Bronze 2. At this time there is a dramatic rise in population with an estimation of about 100 sites in the Chalcolithic versus over 300 in the Early and Middle Cypriot phases (Swiny 2008). Sites occupied during the Philia phase include Marki-Alonia and Kissonerga-*Mosphilia*[1] and settlements representing the later, Early/Middle Cypriot phase include Episkopi-*Phaneromeni,* Marki-*Alonia*, and Sotira-*Kaminoudhia*.

The phase of increased external contact and possible initial settlement of Anatolian migrants in the Late Chalcolithic was followed by one of consolidation and stabilization. This is described archaeologically as the Philia facies of the Cypriot Early Bronze Age (Frankel and Webb 2006; Frankel 2005; Webb and Frankel 1999). Although most of the information on Philia comes from cemeteries, there are two sites with settlement evidence, Kissonerga-*Mosphilia* (Period 5) and Marki-*Alonia* (Phase A-B) (Peltenburg *et al.* 1998; Frankel and Webb 2006). Absolute dates are limited for this

[1] Evdence of Philia at Kissonerga-*Mophilia* comes from disturbed plough zone

phase but the Philia occupation at Marki-*Alonia* (Phase A-B) suggests a range from about 2400 to 2200 BC (Frankel and Webb 2006a) with evidence for a possible migration from southwest Anatolia (Frankel 2005, 19) at about 2400 BC (Webb 2001).

The Philia Phase is transitional between the Late Chalcolithic and the Early Bronze Age of Cyprus (Knapp *et al.* 1990; Webb and Frankel 1999). It is a distinct cultural phase and in all aspects represents change from the preceding period, for example, in the style of domestic architecture, the mode of agricultural production, food preparation, drink, dress, and burial practices (Peltenburg 1996). More specifically, during the Early Bronze Age there were changes with the introduction of ore extraction and copper production and plough-based agriculture. Also, the circular-based domestic architecture of the preceding Aceramic Neolithic, Ceramic Neolithic, and Chalcolithic is replaced by multi-cellular rectilinear structures. There were also changes in burial practices with evidence of individual chamber tombs and extramural cemeteries (Knapp 2008; Frankel and Webb 2006). Changes in domestic technologies include the occurrence of the vertical warp-weighted loom, the low-whorl for spinning, and new ceramic forms, including vessels suitable for containing boiled liquids for cooking and serving vessels, including small bowls, cutaway-spouted jugs, juglets, small jars, amphorae, and flasks. The characteristic pottery type is the Red Polished Philia Ware (Bolger 1991; Frankel and Webb 2006).

Intensification in agricultural practices has been inferred from a significant increase in the occurrence of ground and chipped stone tools used in the processing of cereal crops (Frankel and Webb 2006; Knapp 2008; Webb 2001). The re-introduction of cattle to the island could be the most significant development of the prehistoric Bronze Age (Swiny 2008, 43) because it provided a means for agricultural extensification through plough based agriculture in addition to new source of milk production (i.e. cow's milk) (Knapp 1990; Swiny 2008; Steel 2004).

The Early and Middle Cypriot periods will be discussed together here to provide a general overview of the cultural complexes. The architecture of these phases includes multi-roomed rectilinear mold-made, mud-brick domestic structures with rectangular hearths, low benches, and cemeteries located away from domestic settlements (Webb 2001; Swiny 2008; Frankel 2005). The ground stone assemblage includes mortars, querns, rubbing, and gaming stones (made from igneous rocks) (Frankel and Webb 2006; Swiny 2008), with mortars, basins, rubbers, and querns occurring much more than in previous phases (Frankel and Webb 2006a). There is, however, a marked absence in the occurrence of stone vessels (Frankel and Webb 2006a). New forms of food preparation include cooking in pots and baking in pans and ovens (Webb 2001). Changes in weaving techniques and loom construction involved the use of low-whorl spindles and clay weights for warp-weighted looms (Webb 2001; Frankel 2005). The abstract 'plank-shaped' female figures appear at this time demonstrating new forms of symbolic art (Frankel 2005). Increased numbers of copper artifacts of more complex design, including spearheads, daggers, axes, razors, tweezers, awls, rings, earrings, and bracelets provide evidence both of technological advances in ore extraction and production (Swiny 2008; Webb 2001).

Improvements in metallurgical techniques, in particular, played an important role in increasing external contact and possible migration in the Early Bronze Age of Cyprus. It is argued that an elite northern group living near the copper outcrops (Peltenburg 1996, 27) advertised to Anatolia the island's potential economic resource, which resulted in trade interest with Anatolia (Manning 1993, 35). Debates continue regarding the level of external involvement and contact: some have argued for an indigenous emergent copper-producing group that participated in the overseas copper trade (Knapp 1993; Knapp *et al.* 1990; Manning 1993), whilst others have argued that Anatolians migrated to the island to exploit the copper resources (Frankel *et al.* 1996; Frankel and Webb 2006). Both arguments are well supported and possible. It is likely that increasing external contact with limited migration began in the Late Chalcolithic and increased over time, which subsequently lead to the development of the Late Cypriot urban society. Although excavations at Marki-*Alonia*, Sotira-*Kaminoudhia*, and Episkopi-*Phaneromeni* provide evidence for settlements in the Early and Middle Cypriot periods, more data are needed to better understand the relationship between external interaction, migration, and the development of the Late Cypriot Bronze Age.

2.4 Summary Subsistence on Prehistoric Cyprus

A more detailed discussion of the plant-based subsistence of the island will be presented in Chapter 4 but the faunal evidence will be introduced briefly here. The mammalian fauna of Cyprus is limited and all species either traveled to the island by sea prior to human migration or were introduced by humans, e.g., from the mainland Levant. The species that were on the island prior to human occupation include the Cypriot pygmy hippopotamus (*Phanourios minutus)* and the pygmy elephant (*Elephas cypriotes)*, both of which are small due to an island adaptation (i.e. insular dwarfism) (Simmons 1999; Horwitz *et al.* 2004; Vigne 2011). Wild pigs were introduced from the mainland during the Akrotiri phase and again during the PPNA at *Asprokremmos* and suggest some form of pig management or incipient domestication (Vigne 2011). Vigne (2011) suggests that the pigs were introduced to the island sometime during the mainland Natufian (Late Glacial), decreased in size, and then were hunted by visitors from the mainland Levant (evidence from Ayia Varvara-*Aetokremnos*). By the latest Aceramic Neolithic phase at Parekklisha-*Shillourokambos* and Kissonerga-*Mylouthkia* all species that represent the characteristic Cypriot archaeological assemblage are present, including sheep, goat, pig, cattle, fallow deer, dog, fox, genet, the unintentionally introduced house mouse, and cat (Vigne *et al.* 2000; Horwitz *et al.* 2004; Peltenburg *et al.* 2003) (for list of faunal introductions and assemblages for each cultural phase refer to **Table 2.2**). There is debate regarding the domestication status of the introduced species at the time of import. The argument depends on how much significance is placed on either morphological (Horwitz *et al.* 2004) or non-morphological domestication criteria (Zeder 2008). Domestication criteria based on morphology include a reduction in body size, bone density, and horn form, whereas those based on non-morphological criteria include a shift in age and sex ratios of culled animals, and an increase in targeted species (Horwitz et al. 2004; Vigne 2011).

Morphological criteria suggest multiple introductions of wild populations due to the size of the Cypriot bones, which are large and robust (Horwitz *et al.* 2004). The exception to this is pig, which is the first mammal introduced to Cyprus and appears in assemblages from Akrotiri and Ayia Varvara-*Aetokremnos* (Horwitz *et al.* 2004; Simmons 1999; McCartney *et al.* 2007; Vigne *et al.* 2000). Horwitz *et al.* (2004) argue the small size could be the result of selection for an easier transport. In opposition, scholars that place weight on non-morphological criteria argue for introductions of wild/managed animals that can be considered pre-domestic animals (Clarke et al. 2007; Vigne *et al.* 2009; Vigne 2011). Based on evidence from Akrotiri, Vigne *et al*. (2009) argue that wild pig populations were managed before they were introduced to Cyprus and thus could be considered pre-domesticated. Recent evidence from Parekklisha-*Shillourokambos* supports a model that demonstrates a long time span of increasing intensive control of wild boar populations, which indicated that wild boar management could have occurred more than 11,400 years ago (Vigne 2011). Additionally, Vigne (2011) argues for an introduction of pre-domesticated populations of goat and sheep, with evidence from Parekklisha-*Shillourokambos* suggestive of multiple introductions of different domestic sheep, pig and cattle lineages in the course of the tenth millennium (Vigne 2011). The evidence from Parekklisha-*Shillourokambos* suggests hunting of goats in the earliest phases, more intensive exploitation in the middle phases, and morphological changes evident in the late phases, with modifications of culling profiles suggestive of milk production. Thus the evidence of goats at Parekklisha-*Shillourokambos* provides the first evidence of a domestication process on a Mediterranean island with a new linage of domestic goat appearing at ca. 9400-9000 BP (Vigne 2011). Subsequent to goat introduction, small, horn-modified domestic sheep were introduced. Cattle were bred and are present in the earliest levels of Parekklisha-*Shillourokambos*, Akantou in the north, and Middle/Late Cypro-PPNB Krittou Marottou-'*Ais Yiorkis* but disappears by the Khirokitian, not to return until the Early Bronze Age when they are re-introduced as a domestic species (Vigne *et al.* 2000; Simmons 1998; Croft 1991; Sevketoglu 2000). It has been suggested by Horwitz *et al.* (2004, 38) that the disappearance of cattle could be due to a lack of introduced fresh stock for the maintenance of the island's population. The controlled exploitation and hunting of Mesopotamian fallow deer, which is a unique island adaptation, begins in the Aceramic Neolithic, increases in the Ceramic Neolithic and Chalcolithic, and decreases in the Middle and Late Chalcolithic (Croft 1991). Further, it is the primary meat source for most of the sites until the Late Chalcolithic (Croft 1991; Legge 1982; Vigne and Buitenhius 1999; Peltenburg *et al.* 2000; Vigne *et al*. 2000; Horwitz *et al.*. 2004). Of note, is the evidence of a cat in a human burial at Parekklisha-*Shillourokambos* dating to ca. 7300-7200 BC, which is suggestive of early taming and potential domestication of the animal prior to evidence of domestication in Egypt in the 2nd millennium BC (Vigne *et al.* 2004). Evidence of domesticated cat (and dog) has also been demonstrated earlier in the Cypro-PPNA from the recently excavated Ayios Tychonas-*Klimonas* (Vigne *et al.* 2011b). In addition to the re-introduction of domestic cattle in the Early Bronze Age, there was an introduction of equids (i.e. donkeys) (Croft 1996, 1996; Horwitz et al. 2004; Vigne 1999). It is clear that the faunal record of early Cyprus is complex, with different species at different stages of management and domestication introduced to the island at different times.

Table 2.2 Summary of differences between Cypriot cultural phases (data taken from Webb 2001; Horwitz et al. 2004; Frankel 2005, 21; Simmons 2004; McCartney et al. 2006; Guilaine and Briois 2001; Peltenburg et al. 2003; Todd 2003;Le Brun 2001; Clarke et al. 2007; Peltenburg 1978; Clarke et al. 2007; Clarke 2001; Steel 2004;Todd 1991; Peltenburg et al. 1985; Peltenburg et al. 2003; Peltenburg et al. 2006; Peltenburg et al. 1998; Manning 1993; Peltenburg 1996; Frankel et al 1996; Frankel and Webb 2006; Swiny 2008)

Table 2.2

	Akrotiri	**Cypro-PPNA**	**Cypro-PPNB**	**Khirokitian**	**Ceramic Neolithic**	**Chalcolithic**	**Philia/Early Cypriot**
Notable Innovations or Introductions	Exploratory Phase	Exploratory Phase with evidence for hunter-forager occupations	Migration of crop-based farmers from the mainland	Decrease in Anatolian obsidian	First evidence of pottery	First evidence of olive oil production, bulk storage, return of imported Anatolian obsidian, first evidence of spindle whorls, no direct-fire boiling pots, and new pottery types	Settlement Shift, recti-linear architecture, introduction of the plough, re-introduction of cattle, introduction of the donkey, significant increase in crop processing tools, and new forms of food production consumption technologies
Agriculture	No evidence	No evidence	Migration of crop-based farmers	Hoe-based primary products	Hoe-based primary products	Hoe-based primary products LChal: Olive oil production, bulk storage	Plough-based; backed sickles Secondary Products
Faunal/Faunal Introductions	Pig, dwarf elephants and hippos, genets, mice, birds, marine invertebrates	Pig Fresh water crab fish	Sheep, goat, fallow deer, pig, cattle house mouse, dog, cat, fox, fish, fresh water crab	Sheep, goat, fallow deer, pig, cattle, house mouse, dog, cat, fox, fish remains	Sheep, goat, fallow deer, pig, house mouse, dog, cat, fox	Sheep, goat, pig, deer	Re-introduction of Cattle, sheep, goat, pig, deer, introduction of donkeys and mustelids

Table 2.2

	Akrotiri	Cypro-PPNA	Cypro-PPNB	Khirokitian	Ceramic Neolithic	Chalcolithic	Philia/Early Cypriot
Chipped stone	Thumbnail scrapers, burins, retouched blades, bladelets, flakes	Core reduction	High quality translucent chert, blade-based, projectile points and sickles, unidirectional core technology by Khirokitian	Rough industry, pressure retouch, arrowheads, platform core technology	Continuity from Khirokitian, limestone vessels, axes, adzes, chisels, pierced discs	Long blades, burins, denticulates, scrapers, glossed blades, sickles	Significant increase in chipped stone
Ground stone	No evidence	Grinders, rubbing stones, pestles, quern fragments, pounders, hammer stones	Stone bowl vessels, hammer stones, axes, flaked tools, pounders, grooved stones and mace heads, limestone discs, anvils	Stone vessels, mace heads, incised stones, batons, figurines, and axes	Continuity from Khirokitian, stone bowls, grinders, hammer stones, pestles, and mortars	axes, adzes, anvils, chisels, hammer stones, pestles, pounders, querns, vessels, and rubbers LChal: increase in axes and adzes	Significant increase crop processing: mortars, querns, large clay basins, rubbing and gaming stones NO stone vessels
Evidence of external contact	Exploratory	Chipped stone similar to N. Levant	Anatolian obsidian declines by LPPNB, secondary burials and skull removal, Plant and animal assemblages. Wall paintings	Architectural parallels with earlier mainland phases, decrease in Anatolian obsidian	Evidence of pottery/firing techniques/red paint decoration,, coil and slab method construction,	LChal increasing contact, imported obsidian	New forms of funerary practices, dress, ornaments, agricultural techniques, cooking techniques, gaming stones, architecture, copper
Additional artefacts	Stone and shell beads	Shaft straightener		shells, and bone fishhooks	Picrolite and bone ornaments	Cruciform figurines and figures associated with child-birth, ceramic vessels, picrolite figurines	Cooking pots and baking pans and ovens Abstract ‘plank’ female figures, and genre scenes showing multiple activities

Table 2.2

	Akrotiri	Cypro-PPNA	Cypro-PPNB	Khirokitian	Ceramic Neolithic	Chalcolithic	Philia/Early Cypriot
Architecture	Hearths	pits	Wells, pits, hearths Mud-brick curvilinear structures, post-hole alignments, enclosures	Heavy-walled circular domestic structures	Free-standing, mono-cellular, rectilinear stone and mud brick structures, hearths, pisé and stone benches, partition walls	Single-roomed circular houses Mud-wall construction Central heaths, pits Limited rebuilding and reuse	Multi-roomed rectilinear houses Mould-made mud-brick construction Hearths against side walls Renovation and rebuilding
Burial	No evidence	No evidence	Secondary burials in association with mace heads, caprine carcasses and post-mortem skull removal	Single primary pit burials beneath domestic structure floors	No evidence of grave goods. Possible shift to separate dead from living although evidence is too limited	Pit graves within settlements Limited quantity of grave-goods, Bell-shaped shaft burials LChal: cemeteries and picrolite stop	Rock-cut chambers in extramural cemeteries Large quantity of grave-goods
Textile production	No evidence	No evidence	No evidence	No evidence	No evidence	LChal- crucibles and spindle whorls	Low-whorl spinning Vertical warp-weighted looms Clay weights for warp-weight looms

Table 2.2

	Akrotiri	Cypro-PPNA	Cypro-PPNB	Khirokitian	Ceramic Neolithic	Chalcolithic	Philia/Early Cypriot
Ceramic	No evidence	No evidence	No evidence	No evidence	Coarse ware and Dark burnished ware Household level, open hearths, handmade vessels, hemispherical bowls, ovoid jugs, bottles and hole-mouth jars	Vessels without handles Painted decoration No direct-fire boiling pots Flasks, bowls, jars, goblets, bottles LChal- new pottery RP jugs and bowls, RW replaced by RB stroke-burnished, changes in firing techniques and shift to specialized production	Vessels with handles Incised decoration Specifically made cooking pots Cooking pots, baking pans, braziers, ovens Direct-fire-boiling and serving vessels, spouted jugs, juglets, small jars, amphorae, and flasks RP Philia
Settlement distribution	Little evidence	Little evidence	Concentration on richer, better watered coastal regions	Concentration on richer, better watered coastal regions	Concentration on richer, better watered coastal regions	Concentration on richer, better watered coastal regions	Inland areas of lower rainfall near to copper resources
Metallurgy	No evidence	No evidence	No evidence	No evidence	No evidence	First evidence, chisel and hook, blades, snake ornament from Souskiou	Ore extraction and copper production for tools, weapons and ornaments, spearheads, daggers, axes, razors, tweezers, awls, rings, earrings, and bracelets

Chapter 3

Archaeobotanical Materials and Methods

3.1 Introduction

In this chapter there will be a discussion of the archaeobotanical materials analysed in this thesis and the field and laboratory methods used for their recovery. Presented in the first section is a description of the archaeology of the four sites from which the archaeobotanical samples discussed in this thesis were recovered. The methods used in the separation of the charred remains from the soil matrix and the laboratory methods used in identification will be presented. This will be followed by a discussion of the methods used for the compilation of the archaeobotanical database assembled from sites located in the Levant, Anatolia, Egypt, and Cyprus and dated to the Aceramic Neolithic, Ceramic Neolithic, Chalcolithic, and Bronze Age. The chapter will conclude with a discussion of the quantification and statistical methods used in this research.

3.2 Sampling on site: an overview

A total of 8,721 litres from 217 samples were processed for the analyses of charred plant materials. The samples from Krittou Marottou-'*Ais Yiorkis,* Prastion-*Mesorotsos,* Souskiou-*Laona,* and Kissonerga-*Skalia* were processed and analysed between 2005 and 2010. The author could not be involved at all times in the planning of sampling strategies for the four sites due to limited specialist budgets. As a result there are differences between the sites in the quality and quantity of samples. Labour and availability of water were not limiting factors in the determination of the quantity of soil sampled and as a result volumes of soil sampled were appropriate. Soil was sampled from a variety of archaeological contexts including midden and fire pit fills, occupation levels, floors, hearths, and pot spreads. The samples were stored off-site until such time that they could be processed by method of flotation.

3.3 Krittou Marottou-'*Ais Yiorkis*

3.3.1Krittou Marottou-'*Ais Yiorkis*: archaeological background

Krittou Marottou-'*Ais Yiorkis* is a Cypro-Middle to Late PPNB site located in the foothills of the Troödos Mountains (**Figure 3.1**, photograph of site). The site is located ca. 25 km northeast of the modern town of Paphos, in the upland village of Krittou Marottou. Krittou Marottou-'*Ais Yiorkis* overlooks the Ezousas River, which is ca. 1km away, with a spring located ca. 300m south (Simmons 1998, 2). It was first recorded during the Palaeopaphos Survey by Rupp *et al.* (Rupp *et al.* 1984, 152) and was thought to be a small upland site related to either deer and/or pig exploitation (Simmons 1998, 2005). Dr Alan Simmons of the University Nevada Las Vegas (UNLV) began test excavations at the upland site in 1997 and intensive excavations continued from 2005-2008. It lies on two adjacent modern agricultural terraces at an elevation of ca. 460m above sea level. Notwithstanding damage caused by the construction of the agricultural terraces and natural erosion processes, evidence of Aceramic Neolithic occupation is preserved. The total exposure of the site to date is ca. $288m^2$. Excavations have established the presence of an extensive chipped stone assemblage, a distinctive architecture of circular stone platforms and rubbish pits, and a faunal assemblage that includes cattle (Simmons 2005, 25) (**Figure 3.2**).

The chronology for Cypro-MPPNB occupation is based on 23 radiocarbon dates from animal bone (including cattle), charred macro botanics, and wood charcoal. Of the 23 dates, two come from grains of two-grained einkorn and one from barley. One sample comes from a 160 litre flotation sample from Feature 4 (level 6), and gave a radiocarbon date of 7600-7510 cal. BC[2] (Simmons pers. comm.). The second sample comes from a 150 litre flotation sample from Feature 4 (level 8) and provides a date of 7590-7450 cal. BC[3] (Simmons pers comm.). The radiocarbon dates thus far establish this upland occupation within the Middle Cypro-PPNB, *c*. 7500-7900 cal. BC.

Krittou Marottou-'*Ais Yiorkis* has a series of pits, a possible ditch, and multiple circular platform structures and for which there are no Cypriot or mainland parallels (**Figure 3.3** for site plan). One of the oval pits, Feature 4, measured ca. three meters in diameter and over one meter in depth. It was excavated between 2004 and 2006 and recovered nearly 10,000 chipped stone artefacts and a large amount of faunal remains. Feature 4 also contained charred plant material (Espinda 2007). Feature 17 is a unique circular platform feature with a plastered surface and plaster-lined pit covered with a layer made by mixing chalk and water (Simmons pers comm.). The material culture includes 42 imported obsidian bladelets (one burin), 16 rare projectile point resembling Byblos types, picrolite ornaments and vessels, carnelian bead fragments, limestone/plaster stone

[2] The radiocarbon date Beta-213412 comes from SFN 28 recovered from level 4.6, Feature 4/ unit 20N40W SWQ.
[3] Sample Beta-213415 comes from SFN 37 recovered from level 4.8, Feature 4/ unit 20N40W SWQ.

vessels, sickle blades, axes, ground stone for food processing, including hand stones and grinding slabs, and nearly 200,000 pieces of chipped stone. The chipped stone assemblage is typical of the Cypro-PPNB and there are mainland technological and typological parallels. However, there are no similarities with the assemblages of the subsequent Khirokitian. Feature 4 contained an infant burial, possibly in association to the limestone/plaster vessels. The faunal assemblage includes a large percentage of Persian fallow deer (over 50% of the assemblage) with the remaining composed of pig (30%of assemblage), caprines (16.9%), cattle (< 2% of the assemblage) and a small amount of cat and dog (Simmons pers. comm.). Of particular significance is the presence of cattle, which were introduced to the island during the Cypro-PPNB, disappeared during the Late Aceramic Neolithic, and then was re-introduced at the beginning of the Bronze Age.

3.3.2 Krittou Marottou-'*Ais Yiorkis* field sampling and contexts

The author was present to oversee the recovery of archaeobotanical material during all four excavation seasons. A total of 3,084 litres from 42 samples were collected and processed. **Table 3.1** is a list of the samples including the relevant sample information, context type, and the volume processed for each sample. Samples were collected from pit fills and occupation levels including the surfaces of two circular platform features. The samples were stored off-site until such time that they could be processed. All samples from Krittou Marottou-'*Ais Yiorkis* were processed at either Lemba Archaeological Research Centre (hereafter LARC) or Kouklia Palaeopaphos Museum, where there was water supply available for processing.

Figure 3.1 Krittou Marottou-'Ais Yiorkis site photographs; top photo was taken in spring and the bottom in summer (the foreground of the bottom photograph shows circular platform feature) (Photographs courtesy of Alan Simmons)

Figure 3.2 Photographs of artefacts recovered from Krittou Marottou-'Ais Yiorki: a) section of Feature 4 showing chipped stone concentration, b) stone vessel c) stone vessels d) chipped stone, e) obsidian artefacts (courtesy of Alan Simmons)

Figure 3.3 Photograph of circular platform, Feature 17 (Photographs courtesy of Alan Simmons)

Table 3.1 Krittou Marottou-'Ais Yiorkis context information including sample, trench, feature, feature type, level and volume ('-' denotes not known)

AY	trench	feature	feature type	Level	(l)
SFN28	**20N40W SWQ**	**4.1**	rubbish pit	6	160
SFN43	**20N40W SWQ**	**4 west**	rubbish pit	6	110
SFN32	**20N40W SWQ**	**4.2**	rubbish pit	7	160
SFN37	**20N40W SWQ**	**4.3**	rubbish pit	8	150
SFN46	**20N40W SWQ**	**4.2 west**	rubbish pit	7	50
SFN51	**20N40W SWQ**	**4.4**	rubbish pit	9	25
SFN49	**20N40W SWQ**	**4.3 west**	rubbish pit	8	25
SFN105	**20N45W NE/WQ**	**9**	rubbish pit	9.3	08
SFN107	**20N40W**	**-**	-	24.1	20
SFN48	**20N45W SWQ**	**9.2 west**	rubbish pit	9.2	48
SFN56	**20N45W SWQ**	**10**	rubbish pit	10.2	20
SFN57	**20N45W SWQ**	**13.1**	rubbish pit	2	75
SFN65	**20N45W SEQ**	**13.1/ 13.2**	rubbish pit	½	27
SFN67	**20N45W SEQ**	**4**	rubbish pit	4.4	200
SFN 68	**20N45W SEQ**	**4**	rubbish pit	4.5	350
SFN 70	**20N45W SEQ**	**4**	rubbish pit	4.6	140
SFN71	**20N45W SEQ**	**8**	chipped stone concentration/pit	4.6	30
SFN72	**20N45W SEQ**	**8**	chipped stone concentration/pit	4.7	100
SFN79	**20N45W SEQ**	**4**	rubbish pit	4.10	140
SFN80	**20N45W SEQ**	**4**	rubbish pit	2	40
SFN82	**20N45W NE/NWQ**	**9**	rubbish pit	1	60

Table 3.1 Krittou Marottou-'Ais Yiorkis context information including sample, trench, feature, feature type, level and volume ('-' denotes not known)

AY	trench	feature	feature type	Level	(l)
SFN99	**20N45W NE/WQ**	**9**	rubbish pit	2	20
SFN103	**20N45W NE/WQ**	**9**	rubbish pit	2	20
SFN101	**20N45W NE/WQ**	**9**	rubbish pit	1	20
SFN105	**20N45W NE/WQ**	**9**	rubbish pit	3	8
SFN66	**20N45W SEQ**	**4**	ashy fill of pit	13.3	50
SFN74	**20N45W SEQ**	**4**	limestone/silt fill feature 4	4.8	80
SFN77	**20N45W SEQ**	**4**	primary fill of feature 4 (pit)	4.9	100
SFN53	**15N25W NWQ**	**11**	pit	11.2	50
SFN58	**5N25W NEQ**	**19**	pit	-	60
SFN31	**15N25W NEQ**	**-**	heavy cobble/rock area	9	15
SFN33	**15N25W NEQ**	**10**	pit	-	50
SFN34	**15N25W NEQ**	**10**	pit	-	100
SFN75	**15N45W SEQ**	**-**	-	6	40
SFN81	**15N25W SEQ**	**-**	plaster floor level	7	35
SFN111	**15N25W SWQ**	**-**	-	-	100
SFN 69	**20N30W SEQ**	**-**	plaster lined pit fill	12.	53
SFN83	**20N30W SEQ**	**-**	baked earth	3	55
SFN42	**20N35W SEQ**	**7.3**	pit	3	50
SFN85	**30N50W NWQ**	**19**	pit	19.2	20
SFN112	**30N50W NEQ**	**-**	-	-	100
SFN102	**30N55W NEQ**	**22**	-	22.1	60
SFN104	**30N55W NEQ**	**22**	-	22.2	60

3.4 Prastion-*Mesorotsos*

3.4.1 Prastion-*Mesorotsos*: archaeological background

Prastion-*Mesorotsos* is a multi-period site located 15 km north of Old Paphos in the Dhiarizos River valley. Investigations began in 2009 and the site is currently being excavated by Dr Andrew McCarthy with the University of Edinburgh. Results from the first two seasons (2009 and 2010) revealed a site that covers ca. 10 ha and dates to the following periods: Neolithic; Early, Middle and Late Chalcolithic; possibly Philia, Early, Middle and possibly Late Cypriot I, Archaic/Geometric, Hellenistic, Late Roman, Medieval, and post-Medieval occupation (McCarthy 2010 per. comm.). Archaeobotanical samples have been taken from several contexts from 2009 - 2011; however, this thesis presents the results from the 2009 field season and contexts dated to the Neolithic and Chalcolithic only (Areas V and VI). Thus, the following discussion summarises preliminary results from Areas V and VI (McCarthy pers. comm.).

Areas V and VI are situated on the lower terrace south of a rocky outcrop, both have been affected by natural erosion processes (for site plan refer to **Figure 3.4**). Area VI is situated on the terrace above Area V. Chronology of the site has so far been based on material culture (principally ceramic and lithic assemblages); with Area V dated to the Aceramic Neolithic and Area VI dated to the Late Ceramic Neolithic/Early Chalcolithic transition. Excavated features include rubbish pits, walls, and ephemeral structures (Features 544, 545, and 546) (**Figure 3.5**). Context 566 (fill of rubbish pit 556) is the earliest occupation level excavated so far and is likely to date to the Cypro-PPNB. Preliminary chipped stone analyses show a Late Neolithic industry with technological parallels with the southern Levant. The ground stone assemblage consists of plant processing tools, including querns, rubbers, grinders, pestles, bowls, mortars, and pounders. Preliminary analyses of the faunal assemblage include pig, caprines, deer, fox, and claws of freshwater crab, fish, and bird (McCarthy 2010 pers comm.).

3.4.2 Prastion-*Mesorotsos* field sampling and contexts

The author was involved in the processing of a small portion of the archaeobotanical material from Prastion-*Mesorotsos* (2009) but was not involved in on-site sampling and sampling strategies. A total of 980 litres were processed from 19 samples collected in

2009 from Areas V and VI. All were processed at either LARC or Kouklia Palaeopaphos Museum, where there was water supply available for processing. The samples were collected from midden pit fills and occupation levels. **Table 3.2** is a list of the samples from Areas V and VI including the relevant sample information, context type, and the volume processed for each sample.

Figure 3.4 Area V Plan of Prastion-Mesorotsos showing location of excavation Areas/Trenches (1-8). Plan courtesy of Andrew McCarthy)

Figure 3.5 Photograph of features at Prastion-Mesorotso; a) Area V, b) Area VI, c) Rubbish Pit Feature 501(Photographs courtesy of Andrew McCarthy)

Table 3.2 Prastion-Mesorotsos relevant context information including area of site, context, context type, and volume of sample

PM	**Context**	**vol. (l)**	**context type**
V	**501**	40	soil fill of rubbish pit 502 in south end of trench
V	**518**	20	primary fill of rubbish pit 502, below level of 517
V	**522**	20	fill of pit 505 beneath 503
V	**510**	20	ashy deposit in 505 fill of pit 506.
V	**561**	160	compacted occupational surface around pit 556
V	**548**	120	light brown loose soft fill in N of Area V
V	**551**	50	stone feature, possibly platform or surface in the N of Area V
V	**557**	30	hard compact surface beneath stone feature 551
V	**552**	40	loose brown fill west of stone feature 551
V	**559**	90	dark brown friable occupational deposit
V	**543**	55	general fill/wash
V	**539**	15	fill of pit 545
V	**544**	30	compacted earth surface
V	**526**	20	general fill
V	**554**	90	top (final) fill of fire-pit 556, black and ashy
V	**547**	35	general fill above 561
VI	**549**	50	a low, circular platform composed of calcareous admixtures
VI	**538**	35	building material and collapse from probable structure
VI	**531**	60	light brown loose rubble composed of small cobbles, chipped stone and Late Neolithic sherds

3.5 Souskiou-*Laona*

3.5.1 Souskiou-*Laona*: archaeological background

Souskiou-*Laona* is an early Middle/Middle Chalcolithic settlement site located ca. 2.5 km inland from the modern village of Kouklia on the island's southwest coast. The site measures ca. 2.2 ha. and is located ca. 300m southwest of the Souskiou Chalcolithic cemetery complex (Souskiou-*Laona* and Souskiou *Vathyrkakas* 1-3, Peltenburg *et al.* 2006). The settlement is currently being excavated by Professor Edgar Peltenburg with LARC and the University of Edinburgh. Excavations began in 2005 following the completion of excavations of the cemetery complex (Peltenburg *et al.* 2006). The following summary is based on information from unpublished season reports and from Peltenburg *et al.* (2006).

Souskiou-*Laona* settlement is located on top of a level ridge that drops steeply on three sides which has caused the damage to the site as a result of natural erosion processes. Views from the ridge include the Troödos Mountains to the Northeast, the Mediterranean Sea to the south and the Dhiarizos and Vathyrkakas rivers valleys to the east and west (Peltenburg *et al.* 2006) (**Figure 3.6**). There are three operations/areas of the site that have been excavated: Operations A, B, and D (**Figure 3.7** and for site plan refer to **Figure 3.8**). Operation A is the best preserved area and is located on the lower slope of the East Ridge, Operation B is located on the Northeast Ridge and Operation D is located on the West Ridge. Architecture includes multiple characteristic Middle Chalcolithic circular structures, hearths, fire installations, and rubbish pits (composed of midden-fill and slope-wash) (**Figure 3.9**). Also, there is evidence of human remains (three children and one adult) in pit-graves located within Building 648 (Operation A, Trench 1).

Chronology for the site has so far been established based on ceramic typologies, with three chronological phases: Chalcolithic, early Middle Chalcolithic, and late Middle Chalcolithic. An absence of Early Chalcolithic Glossy Burnished Ware suggests an early Middle Chalcolithic date for initial occupation (Peltenburg *et al.* 2006). Pottery excavated from Operation A is dated to the Middle Chalcolithic, including Red Monochrome Painted Ware and Red-on-White Parallel Band ware. Operation B is dated later than Operation A, with pottery types assigned to late Middle Chalcolithic (i.e. RWL, RMP-b, SE, and CPW-mono). The ceramic types include platters, hemi-bowls, deep bowls, spouted bowls, trays, flasks, goblets on stands, and storage jars. However, the storage jars are rare, which is typical of Middle Chalcolithic pottery assemblages (i.e. Kissonerga-*Mosphilia* and Kissonerga-*Mylouthkia*) (Peltenburg *et al.* 2006).

The site differs from contemporary sites with regards to the distribution and possible significance of the material culture. The total number of picrolite (ornaments and wasters) (**Figure 3.10**) and metal ornaments (i.e. copper) found within the structures at, or around, the time of abandonment have raised questions regarding the function of the site in a regional context (Peltenburg *et al.* 2006). The ornamental artifacts associated with birthing and death in correlation with the abandonment of the structures has lead Peltenburg *et al.* (2006, 85) to view the settlement as a possible regional centre for the distribution of symbolic material culture. For instance, in Operation D (Trench 30) there is a building that has been interpreted as a picrolite sculptor's workplace due to its large number of picrolite wasters and dentalium body ornaments. The ground stone assemblage includes adzes, axes, hammerstones/grinders, pestles, rubbers, chisels, and querns. Additional material culture includes chipped stone, bone and antler objects, terracotta, and picrolite wasters and figurines.

3.5.2 Souskiou-*Laona* field sampling and contexts

The author was not able to be present to oversee on-site sampling and recovery of the samples taken from Souskiou-*Laona*, with the exception of the 2010 season when it was possible for the author to conduct flotation. A total of 2,137 litres from 64 samples were collected and processed from the 2004-2010 seasons. The results from all seasons are included in this thesis with the exception of samples collected from the 2009 field season. Samples were collected from building floors, occupation levels, and midden pit fills. **Table 3.3** is a list of the samples including the relevant sample information, context type, and the volume processed for each sample.

Figure 3.6 Photograph of Souskiou-Laona (top photograph was taken in spring; bottom photograph was taken in summer) (courtesy of E. Peltenburg 2011)

Figure 3.7 Photograph of Souskiou-Laona (courtesy of E. Peltenburg 2011)

Figure 3.8 Souskiou-Laona site plan of the location of Operations, trenches, and settlement in relation to Souskiou-Laona cemetery (courtesy of E. Peltenburg 2011)

Table 3.3 Souskiou-Laona context information including the operation (Op.), trench, unit, context type, and volume of sample

Op.	**Trench**	**unit**	**vol.**	**context type**
A	**20**	**1043**	10	slope wash behind building 897
A	**20**	**1014**	10	wall of building 1015
A	**2**	**741**	20	white plaster hearth associated in B 604
A	**2**	**709**	20	fill of pit 808 below building 13
A	**4**	**30**	26	fill of pit 75
A	**4**	**657**	20	fill of building scoop at back of building 13
A	**4**	**779**	20	pale light brown layer below 471
A	**4**	**31**	10.5	general layer
A	**6**	**70**	30	ashy layer; beneath 58
A	**8**	**64**	55	silt under 55 in building 69
A	**8**	**42**	10	cache in building 69
A	**8**	**62**	60	fill of FT 63
A	**8**	**76**	25	silt layer W section building 69
A	**8**	**81**	160	above floor 82, building 69
A	**8**	**470**	60	upper fill west side of building 69
A	**8**	**485**	40	wall tumble, building 69
A	**8**	**473**	20	directly above floor 82, building 69
A	**8**	**486**	90	below wall tumble building 69
A	**8**	**515**	10	depression in floor 82 with ashy fill
A	**8**	**514**	3	ashy deposit with bone beside hearth 468
A	**8**	**522**	18	directly beneath floor 82, floor packing
A	**8**	**533**	8	fill of 532
A	**8**	**82**	126	Surface in building 69/plaster floor.
A	**8**	**468**	50	hearth in building 69
A	**8**	**528**	11	brown soil stratum beneath 522

Table 3.3 Souskiou-Laona context information including the operation (Op.), trench, unit, context type, and volume of sample

Op.	Trench	unit	vol.	context type
A	**8**	**579**	27	stone and hardcore packing beneath wall 56
A	**8**	**644**	20	dark occupational deposit beneath 528 in building 604
A	**8**	**665**	22.5	ashy deposit in building 604 around N/NW side of hearth 631 (phase 2)
A	**8**	**669**	9.5	Reddish deposit above plaster floor 654 in building 604
A	**8**	**660**	2.5	ashy fill of hearth 631 in building 604
A	**8**	**738**	35	ashy deposit N/NE of hearth 685 in building 604
A	**8**	**673**	5	fill of posthole 672 in building 604 (phase 3)
A	**8**	**810**	10	fill of 809 in building 604
A	**8**	**818**	22	floor/ occupational deposit/ floor packing in building 604
A	**8**	**654**	22	Plaster floor in building 604, beneath 644 (phase 2)
A	**12**	**537**	12	fill of pit
A	**12**	**561**	15	spread under 539
A	**12**	**507**	2	plaster lined feature
A	**12**	**453**	15	compact stony surface; below 452
A	**12**	**539**	17	spread under 461
A	**14**	**524**	27	wall west of wall 9
A	**14**	**628**	20	washed out with plaster inclusions west of wall 627; contaminated
A	**14**	**622**	15	under floor 618 and wall 627
A	**14**	**618**	20	surface of gravels west of wall 9
A	**20**	**767**	25	slope wash in both trenches above 910
A	**20**	**1038**	270	midden fill of pit 1073
A	**20**	**1102**	40	fill of cut 1101
A	**23**	**793**	20	fill of 792 in building 604 (phase 1)
B	**5**	**492**	10	compact white lime deposit against wall 28
B	**5 to 7**	**67**	5	fill of cut from pot spread 36
B	**5 to 7**	**72**	25	fill of pit 71 in building 34

Op.	**Trench**	**unit**	vol.	context type
B	**5 to 7**	**57**	213	ashy deposit within building 34; fill of 495, below 86/below building 34
B	**5 to 7**	**494**	25	dark ashy deposit interleaved with 87
B	**5 to 7**	**508**	8	fill of 507 in building 34
B	**5 to 7**	**87**	46	lower floor level; below 86. floor of B 34 (2nd floor)
B	**5 to 7**	**496**	23	lower slope wash layer
B	**5 to 7**	**551**	38	ashy fill of 650 in B 34
B	**5 to 7**	**641**	3	ashy fill of 649
B	**5 to 7**	**88**	36	occupation deposit below floor 87/floor of building 34 (primary floor)
B	**6**	**45**	72	occupation deposit within Building 34
B	**6**	**96**	2.5	fill of pit 95 in building 34
B	**19**	**802**	5	floor of building 648 below 804
D	**27**	**935**	20	primary floor of building 915
D	**27**	**913**	20	initial collapse of building 915

Figure 3.9 Photograph of circular foundation at Souskiou-Laona (courtesy of E. Peltenburg 2011)

Figure 3.10 Photograph of picrolite ornament recovered from Souskiou-Laona (courtesy of E. Peltenburg 2011)

3.6 Kissonerga-*Skalia*

3.6.1 Kissonerga-*Skalia* field: archaeological background

Kissonerga-*Skalia* is an Early/Middle Bronze Age (EC-MC, ca. 2400-1650 BC) settlement located 300 m from the southwest coast in the modern village of Kissonerga in the Ktima lowland just south of Kissonerga-*Mosphilia* (c. 6000-2400 BC). The site has been excavated for the past five seasons under the direction of Dr Lindy Crewe with the University of Manchester. The following summary is from unpublished field season reports (Crewe pers. comm.).

Notwithstanding damage caused by machine terracing and ploughing for agricultural activity in the 1970s and agricultural activity dated to the Medieval period, the results thus far establish Early and Middle Bronze Age occupation; a period that has not yet been investigated in this region. As yet there are no 14C dates but relative chronologies have been established on the basis of pottery. The pottery includes Drab Polished Ware, Red Polished Ware, late White Painted V-VI sherds, Black Slip handmade, and Plain White handmade pithoi. Excavation has not reached a sufficient depth to make a conclusion regarding initial date of site occupation. However, Crewe suggests, at this time, it is possible that the site could have been occupied at the beginning of the Early Bronze Age and that the occupants could have relocated south from Kissonerga-*Mosphilia*. Thus, results from the site have the potential to contribute to knowledge of the cultural transition between the Chalcolithic, Philia, and Early Bronze Age on the island's southwest coast.

Excavations are now concentrated on the upper agricultural terrace (Plot 199) (for site plan refer to **Figures 3.11 and 3.12**). Trenches B, D, and G-G2 have so far revealed interesting architectural and cultural finds. Trench B was excavated between the 2007-2010 seasons and the architecture includes a large curvilinear building (Feature 33) with an associated plaster-floored courtyard, a large furnace-like structure framed by two stone wall foundations and a series of fire pits, some of which are pottery- or stone-lined (by partial pottery vessels and sherds) (**Figure 3.13**). One particular fire pit was lined with a large Red Polished ware pithos jar. Trench D is earlier than Trench B, with architecture more typical of the Cypriot Early/Middle Bronze Age with a multi-roomed rectilinear structure. Also included in Trench D are pits, a stone and mud-plaster bin, a hearth/fire pit and multiple cooking pots and storage vessels. Trench G - G2 has plaster- and pithoi-lined pits, pots spreads, ground-stone tools, and a crudely constructed large wall. Cultural materials recovered from excavations thus far include beads and pendants, including possible silver artefacts, copper fragments, spindle whorls, a loom weight, and multiple querns and gaming stones. Preliminary results from faunal data include remains of cattle, deer, pig and sheep/goat, crab and shellfish.

3.6.2 Kissonerga-*Skalia* field sampling and contexts

With the exception of the 2009 field season, the author was involved in on-site sampling strategies and recovery of samples. A total of 2,519 litres from 92 samples were collected and processed from the 2007-2010 excavation seasons. Samples were recovered from hearths, plaster floors, occupation levels, pot spreads, rubbish and fire pit fills and from the fill of a mud plaster ‘furnace’. All samples were processed at LARC. **Table 3.4** is a list of the samples including the relevant sample information, context type, and the volume processed for each sample.

Figure 3.11 Kissonerga-Skalia site plan showing the excavation areas (courtesy of L. Crewe pers. comm. 2011)

Figure 3.12 Kissonerga-Skalia site plan of Plot 199, excavation trenches, and outline of a selection of archaeological features (courtesy of L. Crewe pers. comm. 2012)

Figure 3.13 Kissonerga-Skalia, photograph of Trench B, Plot 199 (courtesy of L. Crewe pers. comm. 2012)

Table 3.4 Kissonerga-Skalia contexts, contexts types, unit, and volume of each sample

trench	unit	vol.	context type
A	**46**	20	compact grey, greasy soil feature below [37]
B	**53**	24	dark grey ashy deposit within [33] below [34]
B	**76***	26	stone tumble abutting [62]
B	**59**	35	denser artefact concentration of [27]
B	**72**	10	mid greyish brown silt south of [48]
B	**86**	1	fill of [85]
B	**34**	120	fine ashy dark grey deposit North of [33/ stone and mud plaster ‘furnace’ feature below 27]
B	**163**	20	dark grey, stoney ashy liner fill of [133/ within 33]
B	**132**	25	ashy fill overlying [56/stone and plaster tumble from 33] to the E of [33]
B	**162**	40	mid-brown compact silty outer fill of [133/below 24 within 33]
B	**169**	100	deep red-grey ashy fill of [33]
B	**192**	10	fill of possible pit [194],beneath [189]
B	**189**	10	light brown-grey ashy fill beneath [181/internal mud-brick collapse of 33] in [194]
B	**191**	8	black ash deposit below [188/inside 33]
B	**197**	2	dark grey-black ashy fill of [196/cut for small pit east of 133/within 33]
B	**188**	15	dark ashy fill beneath [181], inside [33]
B	**193**	10	mid brown-grey silty ashy fill of pit [195]
B	**221**	2	dark grey ashy fill of [220/southern end of 33]
B	**215**	8	dark ashy fill below [181] in west half of [33]
B	**223**	2.5	rich ashy fill of 'scoop' in centre of [33]
B	**231**	0.5	dark grey brown silt within stone tube
B	**232**	0.3	creamy brown silt with stone tube
B	**212***	26	compact degraded cream mud plaster associated with [181/internal mudbrick collapse of 33]
B	**233***	26	rich ashy fill of 'scoop' in centre of [33]

Table 3.4 Kissonerga-Skalia contexts, contexts types, unit, and volume of each sample

trench	unit	vol.	context type
B	**272**	30	rich dark fill of [270/pithos within 33]
B	**273**	50	silty fill of [270/pithos within 33]
B	**282**	20	fill of pithos [270] primarily
B	**318**	5	irregular ashy spread
B	**324**	10	fill of scoop [323]
B	**328**	1	dark ashy fill of [327]
B	**326**	1	dark ashy fill of [325/small circular pit]
B	**332**	0.5	rich ashy fill of [331small oval pit]
B	**330**	1.5	rich ashy charcoal fill of [329/sub-circular pit]
B	**305**	20	rich dark ashy fill of[304/cut for scoop at extreme N of 33]
B	**336**	8	Rich ashy fill of [335/cut for pit running NW of 33]
B	**338**	5	rich ashy fill of [337cut for small sub-oval pit running under W of 33]
B	**342**	1	mixed ashy fill of [341/small circular scoop]
B	**340**	1.5	mixed ashy fill of [339/irregular scoop]
B	**344**	1	ashy fill of [343/shallow pit W of 335]
B	**308**	10	rich dark ashy fill of [307/cut for scoop to N of 304/N of 33]
B	**346**	0.3	grey-brown silt fill of [345/possible stake/post hole W of 323]
B	**356**	4	rich ashy fill of scoop/pit [357]
B	**306**	80	mixed deposit to N of [33]
B	**310**	8	mixed silty debris fill of pot spread [309]
B	**206**	5	dark ashy spread to the west of [33]
B	**190**	20	mid grey brown ashy silt in W half of [33]
B	**317**	1	rich ashy silt fill of [316/cut for small circular pit]
B	**321**	8	rich ashy fill of [320]
C	**43**	10	occupational deposit above [44/plaster floor above 60], beneath [39]
C	**60**	10	plaster floor, reddish grey surface beneath [44]

Table 3.4 Kissonerga-Skalia contexts, contexts types, unit, and volume of each sample

trench	unit	vol.	context type
D	**48**	12	wall to Grid South of trench D E-W
D	**41**	12	fill of [40/linear cut through 42]
D	**161**	5	lower fill of [151/small pot emplacement in 122]
D	**150**	5	upper fill of emplacement [151]
D	**145**	15	fill of plaster feature [122]
D	**158**	15	fill of pit [174]
D	**182**	90	mid brown deposit south of wall [48]
D	**209**	50	potential occupation layer below [42] same as [121]
D	**183**	50	deposit below [121], south of wall [58]
D	**218**	20	large potsherd deposit
D	**348**	40	deposit underlying [257/surface]
D	**377**	100	fill of [373/hearth/pit]
E	**64**	23	pot spread on [61] and [45]
E	**68**	25	plaster floor beneath [61] and [64]
G	**52**	13	compact brown soil beneath [36/pinkish brown crumby soil beneath [0]]
G	**77**	12	dark grey ashy and brown soil south of wall [67/linear stone feature]
G	**57**	140	compact yellow soil beneath [54]
G	**55**	40	stones beneath [54], fill of [105/cut of pit]
G	**88**	46	brown soft soil beneath [57]
G	**112**	160	ashy deposit beneath [111/mudbrick collapse]
G	**128**	25	fill of [127/plaster basin adjacent to wall]
G	**134**	30	ashy deposit directly above [135]=[77]
G	**187**	10	fill of [185/pebblecrete curvilinear feature]
G	**154**	2	fill of posthole [153]
G	**207**	160	fill underlying [111/mudbrick collapse] in [67/linear stone feature]
G	**210**	5	amorphous ashy/plaster feature overlaying [213]

Table 3.4 Kissonerga-Skalia contexts, contexts types, unit, and volume of each sample

trench	unit	vol.	context type
G	**214**	35	compact plaster flecked fill under [211]
G	**229**	50	compact yellow surface below [214/compact plaster fill under 211]
G	**237**	2	fill of pit [238/cut into pit 88]
G	**235**	20	pebbly patchy surfaces lies over [88/brown soft soil beneath 57]
G	**249***	26	hard clay fill under [88]
G	**217**	80	stone concentration in the G extension '09
G	**369**	20	deposit under [303/compact pebbly fill] in S extension
H	**101**	20	dark grey ashy silt under [97]
I	**126**	40	fill of pit [125/pit]
I	**131**	55	Pit of [130]
I	**160**	45	fill pit [148]- post packing
I	**159**	20	fill pit [148]- post 'ghost'
I	**168**	45	fill of pit [177]
I	**171**	3	lining of hearth [147]
J	**259**	50	burnt silt bellow [252] / [245]
J	**266**	50	black ashy silt below [259] east of stones

3.7 Retrieval of plant material

The macro botanical remains from the four sites were preserved in charred form and were separated from the soil by systematic water flotation. The methods used in the recovery and processing of the data analyzed here are comparable to methods used previously in Cyprus including the use of a low pressure water flow tap for flotation; sieve sizes of 1 mm and 250 µm; and the use of a low power binocular microscope for identification (Colledge 2003; Murray 1998; 2003). When the author was not there to oversee recovery of charred plant material, multiple students, including undergraduates from the University of Edinburgh and University of Manchester field schools, were able to process the samples.

Due to lack of water on-site, the samples were processed at LARC and the museum at the Kouklia Palaeopaphos Museum where there was running water available for flotation, either from a tap or from a spring. The excavated deposits were not screened prior to flotation. The smallest mesh size used to retain the charred plant remains was a 250 µm mesh ‘flot bag’ or two metal sieves, with mesh sizes of 1mm and 250 µm. Samples were floated in an eighty-five litre metal barrel and the tank was cleaned after each sample had been processed (e.g. when the fine sediment had accumulated to a considerable depth in the bottom of the tank) to avoid cross-sample contamination. Within the barrel was a 1 mm mesh used to catch heavy fractions. The heavy fractions were labeled and dried out of direct sunlight and thereafter sorted for small artefacts and any dense non-floating plant remains at LARC and/or Kouklia Palaeopaphos Museum.

3.8 Sorting of the light fraction

The light fraction was exported with the permission of the Department of Antiquities of Cyprus to the University College London for analysis. The flots (light fraction) were further separated into two fractions: <1mm (coarse flot) and >1mm (fine flot). These fractions were then sorted separately to make the process of identification easier as the eyes accommodate and recognize shapes of the same size more efficiently. Both fractions were sorted and the results thereafter combined. All of the coarse flot was sorted and identified; however, not all of the fine flot was sorted. The decision to sort only a small portion of the fine flot, a quarter of the sample in some instances, was based on time constraints. Fine flot is often more time consuming because of the tiny, and often numerous, charred items that have to be extracted. If only a subset of the fine fraction had been sorted it was necessary to 'multiply up' the total of number of items to represent 100% (e.g. if only ¼ sorted the totals were multiplied by 4) prior to calculating the numbers of taxa for both. If the coarse flot did not contain any charred plant material (e.g., including wood charcoal) a decision was made not to continue to sort the fine flot.

3.9 Identification

The charred material was sorted and all identifiable plant macro-remains (e.g. seeds, nuts, chaff, and charred wood charcoal) were extracted from the flots and analysed under a low power binocular microscope. Wood charcoal was separated from the charred plant remains and sent to Katleen Deckers at Universität Tübingen for analysis. Identifications of the charred material were made by comparing taxa with specimens in the modern reference collection of plant taxa (i.e. seeds, fruits, nuts, etc.) housed at the Institute of Archaeology, University College London, which comprises a majority of accessions that were collected by Professor Gordon Hillman in Turkey, Syria and Jordan. Photographs, drawings, and descriptions of plant taxa were also used to aid identification and with reference to the following publications: Zohary and Hopf (2000), Jacomet (2006), Nesbitt (2006), and van Zeist and Bakker-Heeres (1982, 1984, and 1985). It was impossible to identity all plant remains to species level and thus some have been identified to genus level (e.g. *Triticum*) or to the family level (e.g. Leguminosae) only. The abbreviation 'cf.' is used when a specimen compares with or most closely resembles a particular species or genus. Identification criteria for the taxa identified from the four sites analysed are presented in **Table 3.5** and photographs of charred plant specimens are presented in **Figure 3.14**.

3.10 Compilation of database

All previously published archaeobotanical material from Cyprus, data from contemporary mainland sites, and the new botanical data presented here have been entered into a relational database (Microsoft Access) (cf. the database design described in Colledge *et al.* 2004). The decision to enter the data in a relational database similar to the design described by Colledge *et al.* (2004) is because it facilitates comparative analysis between datasets. The data compiled here include the Cypriot database compiled by the author and two separate mainland databases compiled by Colledge *et al.* (2004) and Simone Riehl. The three databases were amalgamated by Sue Colledge.

3.11 Quantification of the Remains

3.11.1 Counting taxa

The total number of items (e.g. seeds, fruit stones, nuts and chaff elements) and 'whole item equivalents' are counted in the list of taxa. For cereals, the whole grain equivalent was calculated by counting the number of either apical or embryo fragments of wheat, barley and grasses, whichever was the largest, and the larger of the two was the total number of whole grains. Indeterminate cereal grain fragments were converted to 'whole grain equivalents' on the basis of weight. Krittou Marottou-'*Ais Yiorkis* was the only site that had enough whole cereal grains to calculate a 'whole grain equivalent' for cereal grain fragments. For Krittou Marottou-*'Ais Yiorkis*, five ancient charred grains were weighed, three whole grains of *T. monococcum* 2g and two whole grains of *H. sativum* and the average weight of one grain was calculated to be 0.05 grams. However, Colledge (1996, 66) calculates the whole grain equivalent for cereal grain fragments as one grain equal to 0.009 grams. The whole grain equivalent calculated for Krittou Marottou-'*Ais Yiorkis* is large in comparison, so the decision was made to calculate the whole grain equivalent for the other sites based on calculations used by Colledge (1996, 66). The weights of the cereal fragments were divided by the average weight of one grain to calculate the numbers of 'whole grain equivalents'. *Pistacia* sp. nutshell fragments were converted to whole nut equivalents on the basis of weight following the calculation by Colledge (1996, 66). Colledge (1996) calculated the weight of three whole nuts to be 0.07 g. Whole pip equivalents for *Vitis* sp. was calculated as four fragments equal to one whole pip. Whole seed equivalents for legumes were calculated based on the number of halves; two cotyledons equal to one whole seed and four fragments equal to one whole seed.

3.12 Statistical Methods

3.12.1 Univariate methods

The data from Krittou Marottou-'*Ais Yiorkis,* Prastion-*Mesorotsos*, Souskiou-*Laona,* Kissonerga-*Skalia*, and the previously published material from the mainland Levant and Cyprus will be described on the bases of analysis of presence, density, diversity (e.g. by calculating diversity indices) and ubiquity (Wright 2010; Jones 1991). The average number of cereals per litre in each sample was used as proxy for the measure of relative density of charred remains. Percentage presence, or ubiquity, for each taxon is the percentage of the number of samples in which the taxon occurs. Since it is unlikely that absolute numbers reflect original proportions or importance in the past, percentage presence is used (Jones 1991). Ubiquity is also useful in comparisons of data that are the result of various taphonomic and retrieval processes and different identification and recording styles. Also, presence/absence will be used in comparisons between archaeological sites from the mainland Levant and Cyprus since for some sites presence/absence data is all that has been recorded and/or published. Presence/absence has been shown to be a useful level of analysis in comparative investigations of large datasets. Further, the information that is eliminated at the level of presence/absence (i.e. absolute counts) has been shown to influence the larger trends in datasets only minimally, thus the important trends in the data are shown at the level of presence/absence (Lange 1990; see also discussion in Colledge *et al.* 2004).

3.12.2 Multivariate methods

Multivariate analysis is useful for archaeobotanical datasets that include multiple variables and many samples. The dataset compiled to address the research questions of this thesis includes many plant taxa (variables) and multiple archaeological sites from several cultural phases (samples). Multivariate techniques are useful for comparisons of material from different sites because they help reduce noise as a result of variations in preservation, sampling, recovery, and identification. Lange (1990) states, with regards to multivariate techniques: "Redundancy of information is summarized, noise is reduced, outliers can be identified and relations brought to light."

3.12.3 Correspondence Analysis

Correspondence analysis (hereafter CA) is a multivariate statistical technique that is useful in the analyses of abundance data and thus is the method that will be used here to simplify the complex data set. CA graphically displays the relationships between complex datasets (Bølviken 1982). Lange (1990, 43) states, "In graphical form the results of a Correspondence Analysis bring out the position of each sample relative to all other samples and to all the species, and of each species relative to all other species and to all the samples in the analysis" (Lange 1990, 43). Further, "with correspondence analysis the relationships between cases, those between variables, and those between variables and cases, may all be analysed together and represented in the same scattergram or series of scattergrams" (Shennan 1988, 284). The aim by using CA is to demonstrate any temporal patterning in the samples/sites in the dataset that is associated with specific plant use/exploitation. The computer software used to perform CA was CANOCO (Ter Braak 1988). CANODRAW (Smilauer 1992) was used to graphically plot the output from the analyses.

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	**Notes compiled by author and other references**
Cereals	
***Triticum monococcum* 2g** **(two-grained einkorn wheat grains)**	The grains of two-grained einkorn have a flat ventral surface as opposed to a rounded ventral surface, as in the one-grained variety, when viewed laterally. The grains are asymmetric in cross section and when viewed dorsally or ventrally the sides are slightly convex. In a lateral view the ventral surface is flattened and the dorsal surface has a lop-sided dorsal ridge. Both apical and embryo ends are attenuated and the ventral furrow is compressed. "Ventral side of these grains is not curved but straight and flat as in emmer wheat grains. They can be distinguished from emmer grains by their great slenderness and by their more pointed upper and lower ends" (van Zeist and Bakker-Heeres 1982, 190). Further, "two-grained einkorn grains in contrast (to one-grained einkorn) show a flat ventral side as a result of two grains having been pressed together in one spikelet. Like one-grained einkorn they have a slender form and more or less pointed ends (dorsal view) and the furrow is compressed (opposite to emmer)" (Kreuz and Boenke 2002, 235).
***Triticum* cf. *monococcum* 2g** **(cf. two-grained einkorn wheat grains)**	Due to poor preservation the grains that have been assigned to '*T*. cf. *monococcum* 2g' were relegated to 'cf' because they are most similar to grains of two-grained einkorn but could not be identified to species with great confidence.
***Triticum monococcum* 1g** **(one-grained einkorn wheat grains)**	The most characteristic features of grains of one-grained einkorn are the grains are laterally compressed and have a strong dorsal ridge. Similar to grains of two-grained einkorn the grains are asymmetric when view in cross-section and both the apical and embryo ends are tapered. In contrast to grains of two-grained einkorn, when viewed laterally the ventral cheeks appear more or less equally rounded on each side as opposed to a flat ventral surface. "The grains (of one-grained einkorn) are laterally compressed, with longitudinally curved ventral and dorsal sides" (van Zeist and Bakker-Heeres 1982, 190).

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	Notes compiled by author and other references
***Triticum monococcum* (1/2 g)** **(einkorn wheat one/two-grained undetermined)**	For the grains assigned to *Triticum monococcum* (1/2 g) it was not possible to distinguish on the basis of overall morphology between the two types due, in part, to poor preservation and fragmentation. In cross-section the grains are asymmetric. When the grains or fragments are viewed ventrally they are slightly laterally compressed.
Triticum dicoccum **(emmer wheat grains)**	The grains of emmer wheat are more commonly rounded at the apical end when viewed dorsally and are tapered at the embryo ends. In lateral view, the grains have a flat or lightly concave ventral surface with the highest point above the embryo on the rounded dorsal side (Jacomet 2006).
Triticum* cf. *dicoccum **(most similar to emmer wheat grains)**	Grains or fragments assigned to 'cf.' emmer wheat due to poor preservation. They are most similar to emmer wheat in cross-section with a slightly rounded apical end.
Triticum monococcum **(einkornwheat glume bases)**	In abaxial view the angle between the lower parts of the two primary keels (glumes) is relatively small and measures less than 90°, as opposed to the angle observed in emmer wheat which is larger than einkorn and measures greater than 90°. When viewed in cross-section the shape of the lower part of the glume base is rounded and almost rectangular as opposed to clearly rectangular as in the glume bases of emmer wheat. When viewed laterally the internode is broad in relation to the width of the spikelet (Jacomet 2006). "The spikelets of einkorn wheat are smaller and more slender than those of emmer wheat" (van Zeist and Bakker-Heeres 1982, 193).
Triticum dicoccum **(emmer wheat glume bases)**	In abaxial view the angle between the lower portions of the two primary keels (glumes) is large and measures greater than 90°. When viewed in cross-section the shape of the lower part of the glume base is clearly rectangular and is somewhat thinner than the shape of the lower part of the glume of einkorn wheat. When viewed laterally the internode is narrow in relation to the width of the spikelet as opposed to glume bases of einkorn wheat which are broad in relation to the width of the spikelet (Jacomet 2006).

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	**Notes compiled by author and other references**
Hordeum sativum **(domesticated hulled barley)**	The two main criteria for separation between domesticated varieties of barley is the number of fertile spikelets per rachis segment and hulled versus naked grains. There are naked and hulled forms of both two-rowed and six-rowed barley. The most diagnostic characteristic of grains of barley, both hulled and naked, are that they are symmetric in cross-section as opposed to asymmetric in cross-section as in the glume wheat. The differences between grains of the naked versus the hulled forms are as follows. In cross-section the grains of naked barley are round and the grains of hulled barley are flat-sided. The ventral furrow in naked barley is wide as opposed to shallow and v-shaped as in the hulled form. The apical end of naked barley is either rounded or notched and the apical end of hulled barley is more flattened. Further, the difference between grains from spikelets with six-rows as opposed to two-rows is that in the six-rowed variety there are both symmetrical and asymmetrical grains as opposed to only symmetrical grains in the two-rowed variety. The ventral furrow of the asymmetrical grains appear twisted in a proportion of the grains from the six-rowed variety (Jacomet 2006). All the grains identified in the samples were from the hulled variety. These grains were identified by symmetry in cross-section; a wide and shallow ventral groove; in lateral view the ventral and dorsal surfaces are convex; and both apical and embryo ends are tapered. There were not very many grains of hulled barley recovered from the samples and thus it was difficult to determine the presence and/or proportion of grains from the two-rowed or six-rowed variety. However, there was one asymmetric grain recovered from the Souskiou-*Laona* samples. Grains assigned to 'cf.' were assigned due to poor preservation and/or fragmentation.
Cereal indeterminate	The fragments assigned to cereal indeterminate were too badly preserved or too distorted from charring to identify to genus.
Identification of pulses and flax	
Cicer arietinum **(chickpea)**	The fragments of chickpea in the samples were poorly preserved and consequently, the radicles were not preserved. The specimens are similar to those described by van Zeist and Bakker-Heeres (1982, 209) and are angular with wrinkled surfaces and the vestiges of a protruding 'beak' are visible.

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	**Notes compiled by author and other references**
Lens culinaris **(lentils)**	The specimens of lentils are flat and circular. However, based on poor preservation and fragmentation some specimens assigned to lentils have been relegated to genus level and some have been relegated to 'cf' (most similar to lentil).
Linum bienne/usitatissimum **(flax)**	The specimens of flax in the samples are flat in cross section, oval in outline, with a slight indentation at the apex.
Pisum* cf. *sativum **(cultivated pea)**	The whole peas in the assemblage are bilaterally symmetrical and spherical in shape. Some specimens of pea have been relegated to 'cf' genus due to poor preservation and fragmentation. Also, some specimens have been assigned to 'cf *sativum/elatius*' because it is difficult often difficult to determine wild or domesticated status.
Identification of trees and shrubs	
Ficus carica **(fig)**	The pips of fig are similar to those described by van Zeist and Bakker-Heeres (1982, 228). They are laterally compressed, ovate in outline with a pointed apex and a smooth surface. "Laterally compressed pips, ovate in outline, pointed at the apex. The small circular hilum below the apex has often not been preserved in the charred pips." (van Zeist and Bakker-Heeres 1982, 228)
Olea europaea **(olive)**	The stones of olive are spindle-shaped when viewed laterally, circular in cross-section, and often both ends are attenuated.
Pistacia* sp. *atlantica/terebinthus **(pistachio)**	The whole nutshells of pistachio are similar to those described by van Zeist and Bakker-Heeres (1982, 211). The specimens are laterally flattened, elliptic in outline with a smooth surface. "The *Pistacia* nutshells are laterally flattened; elliptic to broadly elliptic in outline…the nutshell is smooth." (van Zeist and Bakker-Heeres 1982, 210)

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	**Notes compiled by author and other references**
***Vitis vinifera* (grape)**	The pips of grape are pear-shaped with a protruding beak and a notched inferior end when viewed dorsally. When viewed ventrally there are two deep furrows lateral of a central bridge. There is variation amongst the pips in the assemblage with some beaks and bodies more elongated than others.
Wild herbaceous taxa	
Ajuga chamaepitys **(ground pine)**	The ground pine in the samples is characterized by a large hilar scar on its ventral side, tapered superior end, and a wide apical end. The specimens are morphologically similar to those which have been described by van Zeist and Bakker-Heeres (1985, 259). For *Ajuga* sp. “Fruits broadly obovate in outline with a large hilar scar on the ventral side and a reticulate surface structure. Fruits with lamina longitudinally elongated towards the base…” (van Zeist and Bakker-Heeres 1985, 259).
Amaranthus retroflexus **(redroot pigweed)**	The specimens of redroot pigweed are lenticular with ridged margins and a smooth surface. They are similar to those described by van Zeist and Bakker-Heeres (1984). “Lenticular seed with a ridged margin, surface smooth” (van Zeist and Bakker-Heeres 1984, 179).
***Avena* sp.** **(oat)**	The grains of oat are characterized by an ovular cross-section, with a slight depression superior to the embryo and a narrow, shallow ventral groove. “Caryopses elliptic to oblong in outline. The greatest width is in the middle of the grain, only slightly tapering towards the rounded apical and basal ends. The fruits are dorso-ventrally somewhat compressed. Especially in the lower part of the grain, at both sides a lateral keel is present if the grain is not too swollen. The hilum in the narrow ventral groove ends at a short distance from the apex” (van Zeist and Bakker-Heeres 1982, 219).
Arrenatherum elatius **(false oat-grass)**	False oat is characterized by a circular cross-section and is tapered at both the apical and embryo ends. The grains are elongated with the widest part at the mid-section.

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	Notes compiled by author and other references
Bolboschoenus* cf. *glaucus **(sea-clubrush)**	The nutlets of sea clubrush are similar to the specimens described by van Zeist and Bakker-Heeres (1982, 217) and are egg-shaped and attenuated at the base. These have recently been identified as B. glaucus (Wollstonecroft et al. 2011) "Nutlets obovate in outline, tapering towards the base. The ventral side is more or less flat, while the dorsal side is roof-shaped with a rounded median ridge" (van Zeist and Bakker-Heeres 1982, 217).
Brassica* cf. *alba **(white mustard)**	The seeds of white mustard are spherical and textured, with very tiny bumps on the surface. Due to poor preservation some seeds have been lowered to 'cf.' genus.
cf. *Bromus* sp. (brome grass)	The grains of brome grass are slender and flattened, with a blunt apex and rounded dorsal surface. They are similar to those which are described by van Zeist and Bakker-Heeres (1982). "Flat fruits; the dorsal side is usually domed in cross-section, the ventral side from more or less flat to hollow (channeled). Pointed basal end with a rather small, narrow embryo. The linear hilum does not reach the apex of the fruit. Various caryopses have a glossy surface. The archaeological *Bromus* fruits vary quite markedly in size and shape." (van Zeist and Bakker-Heeres 1982, 219)
Buglossoides tenuiflora **(gromwell)**	The nutlets are similar to those described by van Zeist and Bakker-Heeres with wart-like projections on the surface and pointed apexes. "The nutlets are strongly bigibbous (the most characteristic feature), with an elongated, rather pointed apex. The base is conspicuously small compared to that in *Lithospermum arvense* nutlets. The surface is densely covered with wart-like projections" (van Zeist and Bakker-Heeres 1982, 212-213)
***Carthamus* sp.**	Seeds of distaff thistle are characterized by an elliptical outline and are laterally compressed, with a narrowing at the dimpled end.

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	**Notes compiled by author and other references**
(distaff thistles)	"The fruit is elliptic in outline, laterally somewhat compressed, with a distinct margin. The pappus rim and the indentation at the base are comparatively small" (van Zeist and Bakker-Heeres 1982, 215).
Euphorbia helioscopia **(sun spurge)**	There are two- types of spurge in the samples. The first is most similar to sun spurge as described in the seed identification handbook as "oval-elliptical, with a ridge on one side, large scar, and network of ridges" (NIAB, 35) and it has a slightly rounded apex and a rounded base. The second type of spurge was relegated to genus level due to poor preservation. It is slightly quadrangular and regularly pitted and is most similar to petty spurge (*Euphorbia peplus*) as described by The Seed Identification Handbook (NIAB p. 35). Van Zeist and Bakker-Heeres (1984, 254) describe two seed-types; one is "oblong in outline, truncated at the apex and pointed at the base. Quadrangular in cross-section. Surface pattern of low, obtuse knobs" and the second type are "obovate in outline, with rounded apex and tapering at the base, circular in cross-section., surface alveolate (with shallow depressions or dent)" (van Zeist and Bakker-Heeres 1984, 254).
***Fumaria* sp.** **(fumitory)**	The seeds of fumitory are circular in outline and the surface is rough. They are similar to those described by van Zeist and Bakker-Heeres (1982); however there does not appear to be rounded holes at the base. This is probably a result of poor preservation. "Bi-convex fruits, almost circular in outline, sharp (slightly winged) margin. A characteristic feature is two rounded holes at the base of the fruit. The surface is rough" (van Zeist and Bakker-Heeres 1982, 228).
***Galium* sp.** **(bedstraw)**	The seeds of bedstraw are characterized by a spherical shape with a circular concavity on the ventral side. They are morphologically similar to those described by van Zeist and Bakker-Heeres (1982). Some specimens were relegated to 'cf.' due to poor preservation. "Hemispherical fruits, with a round concavity on the ventral side indicating the position of the hilum." (van Zeist and Bakker-Heeres 1982, 231)
Gramineae indeterminate **(grass family)**	It could not be determined if these fragments assigned to the grass family were fragments of domesticated cereal grains or from wild/weed species.

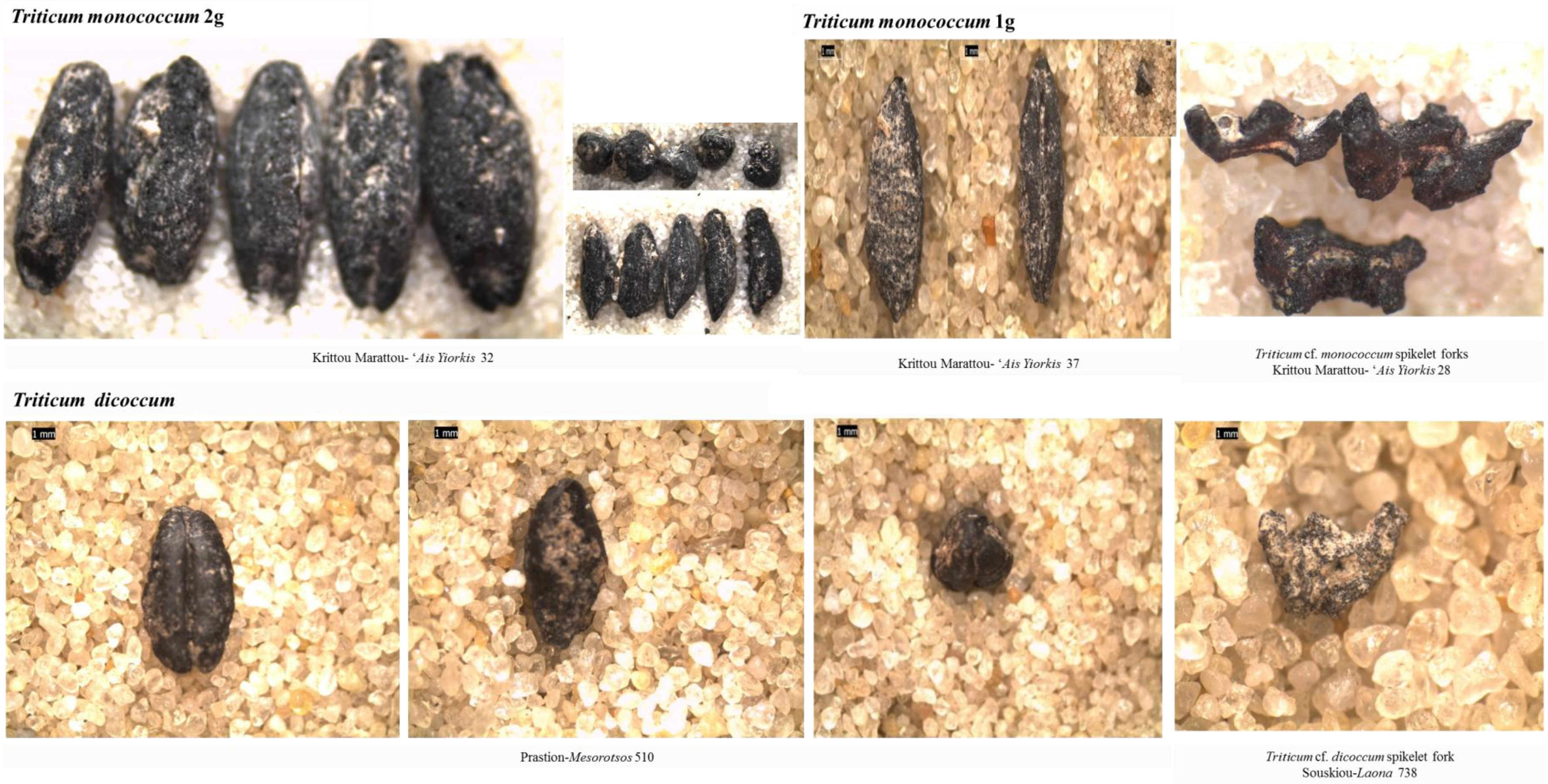
Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	**Notes compiled by author and other references**
***Heliotropium* sp.** **(heliotrope)**	The grains of heliotrope are characterized by a protruding hilum and an ellipsoid outline. The specimens are similar to those described by van Zeist and Bakker-Heeres; however, the surfaces are not wrinkled. "Slightly compressed nutlets, ovate in outline, with ridged margin in the upper part of the fruit. Surface irregularly wrinkled. A characteristic feature is the protruding hilum." (van Zeist and Bakker-Heeres 1982, 212)
Leguminosae indeterminate **(large/small) (legume family)**	The specimens that have been assigned the legume family could not be identified to genus level due to poor preservation and fragmentation. Further, the specimens assigned to indeterminate, legume small, or legume large include seeds from multiple genera that are similar in shape and size, and therefore cannot be easily identified to genus level.
***Lolium* sp.** **(rye-grass)**	The grains of rye-grass are characterized by a flat ventral surface, a domed dorsal surface, and are compressed dorsally and ventrally. The greatest width is in the middle of the grains and the apical ends are rounded. There was variation amongst the grains but generally, morphologically similar to those described by van Zeist and Bakker-Heeres (1982). "Dorso-ventrally compressed caryopses with flat ventral side and more or less domed dorsal side. The greatest width is in the middle of the grain, slightly tapering towards the upper and lower ends. The apex is rounded to truncate. In many specimens parts of the rough enveloping bracts (finely papillose) are still preserved." (van Zeist and Bakker-Heeres 1982, 222)
***Malva* spp.** **(mallow)**	The seeds of mallow are characterized by a deep hilar notched and have a concave surface and smooth seed walls. There are similar to the seeds described by van Zeist and Bakker-Heeres (1982). "The reniform seed has a deep hilar notch; the surfaces are slightly concave. The seed is thinnest at the inner (ventral) side. Smooth seed wall." (van Zeist and Bakker-Heeres 1982, 228)
***Pisum/Vicia* spp.** **(pea/vetch)**	The seeds assigned to intermediate between pea and vetch were either too fragmented or poorly preserved to assign them to either genus with confidence.
***Rumex* spp.**	The seeds of sorrel/dock are similar to those described by van Zeist and Bakker-Heeres (1982); however

Table 3.5 Identification criteria for cereals and non-cereal taxa

Taxa	Notes compiled by author and other references
(sorrel/dock)	due to poor fragmentation the specimens have not been assigned to species and have been relegated to genus level only. "The three-sided fruits have ridged margins. Triangular in outline, acute at the apex and with a broad base. The fruit wall has a fine, but distinct strate surface pattern" (van Zeist and Bakker-Heeres 1982, 229).
***Stipa* sp.** **(feather grass)**	The grains of feather grass are characterized by a circular cross-section, a tapered end, a rounded apical end, and are laterally compressed.
Thymelaea* cf. *passerina **(shaggy sparrow wort)**	The seeds that were assigned as most similar to shaggy sparrow wort are characterized by a smooth surface and a tapering, rounded base. "Fruits acuminate (tapering to a long point) rounded at the base" (van Zeist and Bakker-Heeres 1982, 231).
***Vicia/Lathyrus* sp.** **(vetch/grass pea)**	The seeds assigned indeterminate between vetch and grass pea were either too fragmented or poorly preserved to assign them to either genus with great confidence.
cf. *Vicia* sp. **(vetch)**	The fragments of vetch were relegated to 'cf.' because they were too poorly preserved to be assigned with to the genus with great confidence. "large variation in shape: almost spherical to compressed (bi-convex) types occur, some specimens are rounded-cubical, while other seeds have one or two flat sides" (van Zeist and Bakker-Heeres 1982, 227)

Figure 3.15 Selection of images of charred plant specimens from Kissonerga-Skalia, Krittou Marottou-'Ais Yiorkis, Prastion-Mesorotsos, and Souskiou-Laona (in the order outlined in Table 3.5) (images produced by Leica LAS EZ and with assistance from Charlene Murphy)



Hordeum sativum

Prastion-*Mesorotsos* 522

Kissonerga-*Skalia* 131

Souskiou-*Laona* 551

Prastion-*Mesorotsos* 561

Kissonerga-*Skalia* 348

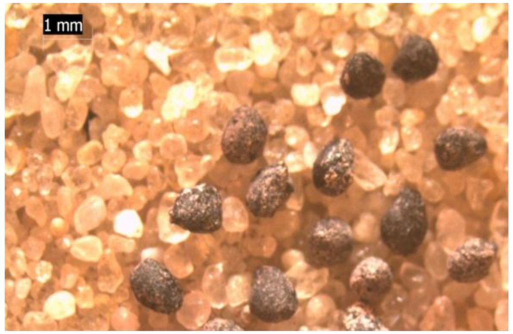
Krittou Marattou- '*Ais Yiorkis* 28

Cicer cf. *arietinum*
Kissonerga-*Skalia* 76

Lens sp.
Prastion-*Mesorotsos* 531

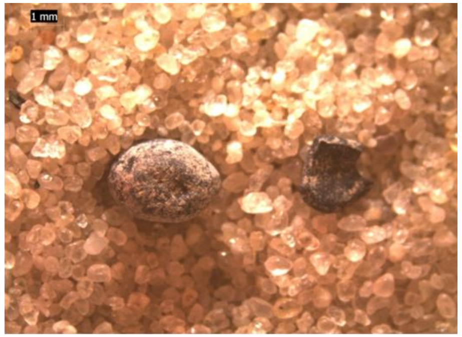
Linum sp.
Prastion-*Mesorotsos* 543

Linum sp.
Souskiou-*Laona* 468



Ficus carica
Kissonerga-*Skalia* 233

Olea sp.
Krittou-Marattou-'*Ais Yiorkis* 68

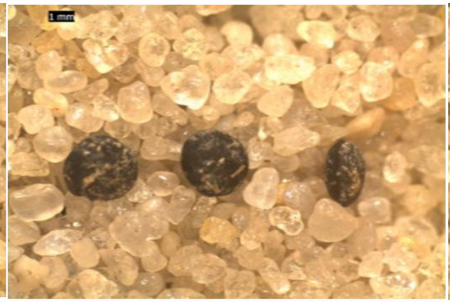


Pistacia cf. *atlantica/terebinthus*
Kissonerga-*Skalia* 88

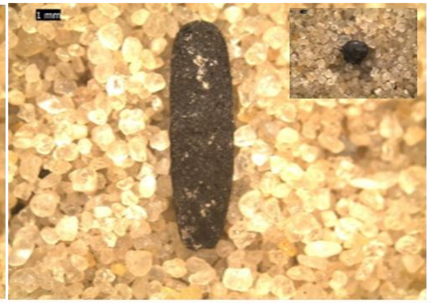
Vitis vinifera
Kissonerga-*Skalia* 112

Vitis vinifera
Kissonerga-*Skalia* 59

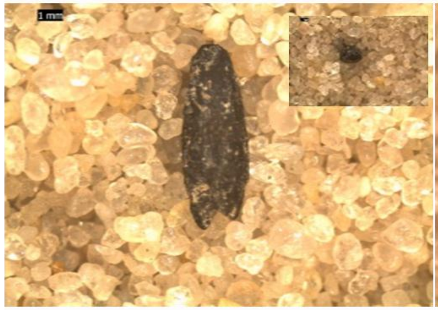
Ajuga chamaepitys
Kissonerga-*Skalia* 348



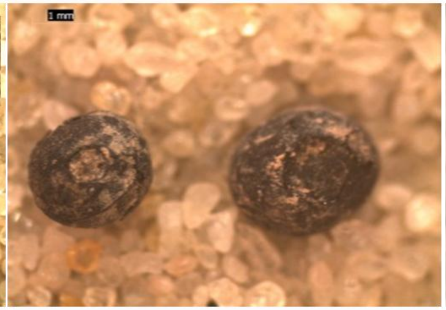
Amaranthus cf. *retroflexus*
Kissonerga-*Skalia* 183



Avena sp.
Krittou Marottou-'*Ais Yiorkis* 28

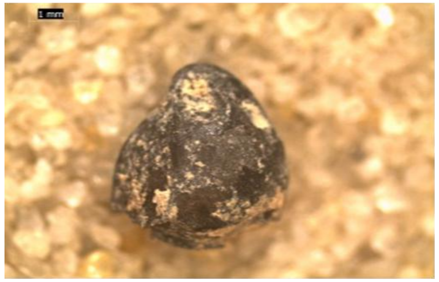


Arrenatherum elatius
Kissonerga-*Skalia* 57

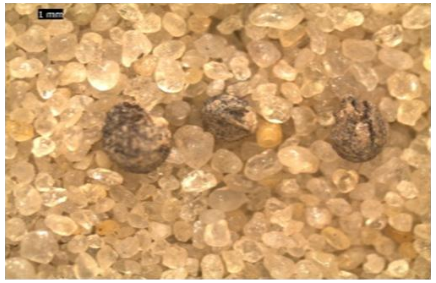


Brassica cf. *alba*
Prastion-*Mesorotsos* 557

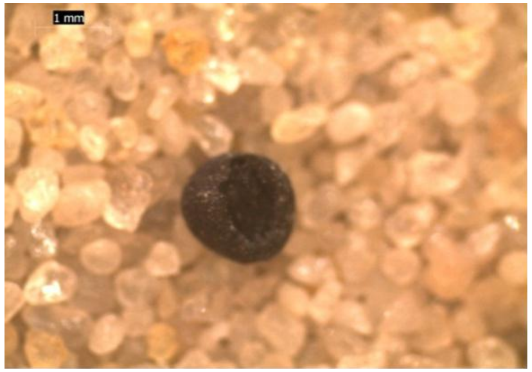
Buglossoides tenuiflora
Soukiou-Laona 810



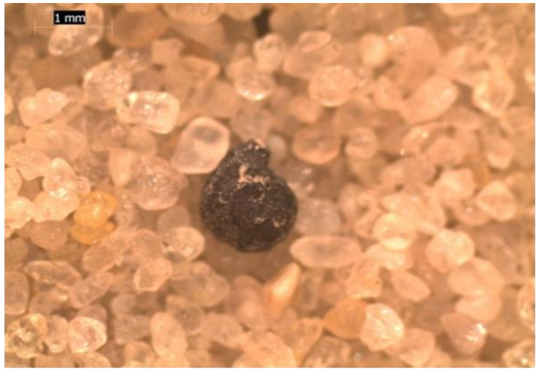
Carthamus sp.
Kissonerga-*Skalia* 17



Euphorbia cf. *helioscopia*
Kissonerga-*Skalia* 169

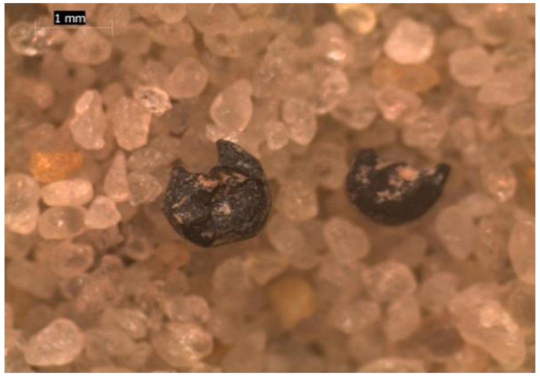


Galium sp.
Souskiou-*Laona* 1102



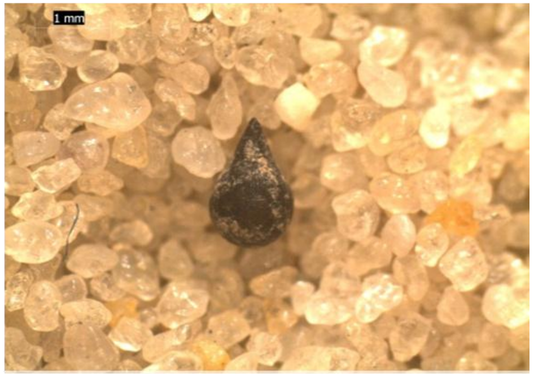
Heliotropium sp.
Kissonerga-*Skalia* 348

Lolium sp.
Kissonerga-*Skalia* 55



Malva sp.
Kissonerga-*Skalia* 348

Rumex sp.
Kissonerga-*Skalia* 259



Thymeleae cf. *passerina*
Kissonerga-*Skalia* 266

Chapter 4

History of Cypriot Archaeobotany

4.1 Introduction

In this chapter there will be a brief discussion of the history of the use of flotation for the recovery of plant remains in Cyprus. Different methods of sampling, recovery and identification have been used on sites in Cyprus and a summary of these will be presented, in addition, previous archaeobotanical research undertaken on Aceramic Neolithic to Late Bronze Age assemblages will be described.

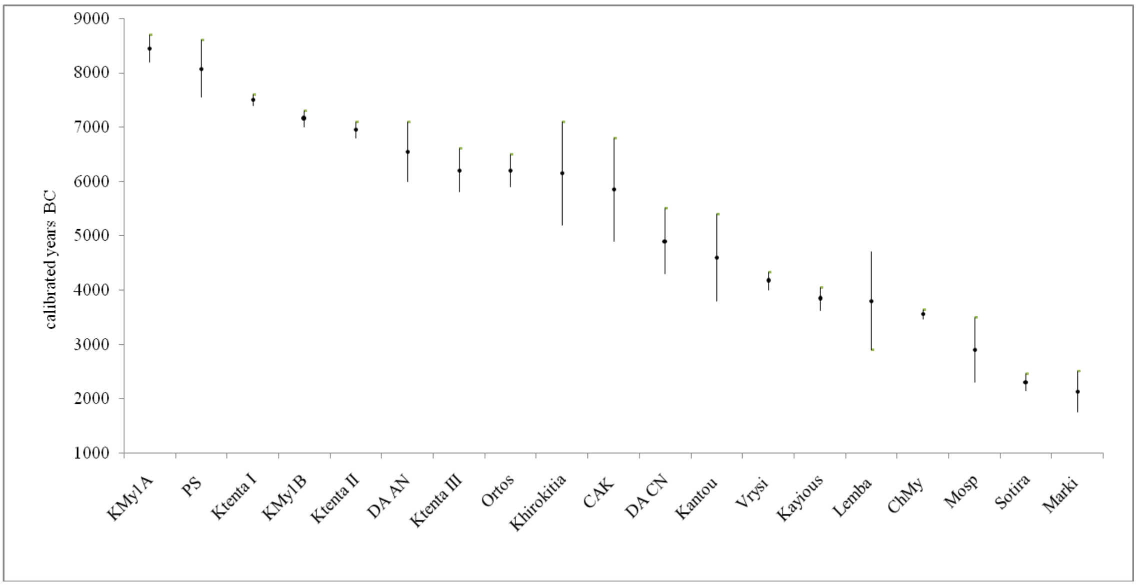
4.2 Presentation of taxa

Table 4.1 is a list of Cypriot archaeobotanical publications that include site-based reports and summaries, and syntheses covering sites dated to the earliest phases of island occupation to the Late Bronze Age. The recovery methods used, the number and volume of samples, and whether any information regarding provenience of the plant material for each site dated from the Aceramic Neolithic to the Middle Bronze Age is presented in **Table 4.2**. Presence/absence records for cereals and non-cereal taxa from sites dated to the Aceramic Neolithic to the Middle Bronze Age are listed in **Table 4.3**. The taxa recovered from sites dated to the Late Bronze and later have been combined for a more general comparative discussion in **Table 4.3**. The cereal taxa are presented first followed by trees/shrubs and wild herbaceous taxa listed in the order and nomenclature of the Flora of Cyprus (Meikle 1977, 1985). The total number of taxa presented in the bar charts discussed in sections 4.3-4.8 below omits presence at the family level. For a list of crop and tree species that first appear in each cultural phase refer to **Table 4.4**.

4.3 Chronology

Radiocarbon dates have been re-calibrated using Ox Cal v3.10, with the IntCal09 calibration curve (Bronk Ramsey 2006; Reimer *et al.* 2004). All chronological determinations are expressed in calibrated years BC. Unless otherwise stated, the average calibrated date is based on a point estimate age with 1-sigma of the summed probability (one standard deviation), which will be used in this discussion to assess an estimated chronology for crop and weed introductions to the island. The calibrated radiocarbon dates are presented in **Appendix 1** and the summed average calibrated dates are illustrated in **Figure 4.1**. The dates in **Figure 4.1** represent the calibrated dates from sites with archaeobotanical data, and the dates illustrate relatively continuous occupation from the Aceramic Neolithic (ca. 8500 cal. BC) to the Middle Bronze Age (ca. 1900 cal. BC), the time period this thesis examines.

Figure 4.1 Calibrated radiocarbon dates based on one standard deviation[4]



4.4 Introduction of flotation techniques in Cyprus

The introduction of flotation techniques is significant in the history of archaeobotany worldwide. Flotation facilitated much larger quantities of plant remains (comprising both large and small taxa, as opposed to hand-picking) to be recovered that were much more likely to be representative of the full suite of charred remains preserved in occupation deposits. Standardisation of recovery systems thus meant that comparison of archaeobotanical data between periods, sites and regions was possible (i.e., not limited due to the likelihood of differential recovery of plant taxa). The first experiments with flotation began in 1962 on the Lowillva project in Illinois, and in 1968 Streuver published a description of the process for which charred material could be separated from excavated soils sampled from archaeological sites (Streuver 1968). In 1963 Hans

[4] *Kissonerga-Mylouthkia (n=5) (Peltenburg 2003); Perekklisha-Shillourokambos (n=9) (Guilaine 2003); Kalavasos-Tenta (n=16) (Todd 2005); Dhali-Agridhi (n=5); Cape Andreas-Kastros (n=3) (le Brun 1981, p. 71); Kholetria-Ortos (n=6) (Simmons 1994); Khirokitia-Vounoi (n=17) (Le Brun 1994, 1991); Ayios Epiktitos-Vrysi (n=17) (Peltenburg 1982c); Kantou (n=2); Lemba-Lakkous (n=9) (Peltenburg 1985)); Kissonerga-Mosphilia (n= 30) (Peltenburg 1998); Chalcolithic Kissonerga-Mylouthkia (n=9) (Peltenburg 2003); Kalavasos-Ayious (n=4) (Todd and Croft 2004); Marki-Alonia (n=9) (Frankel and Webb 1992); Sotira-Kaminoudhia (n=9) (Swiny et al.2003.*

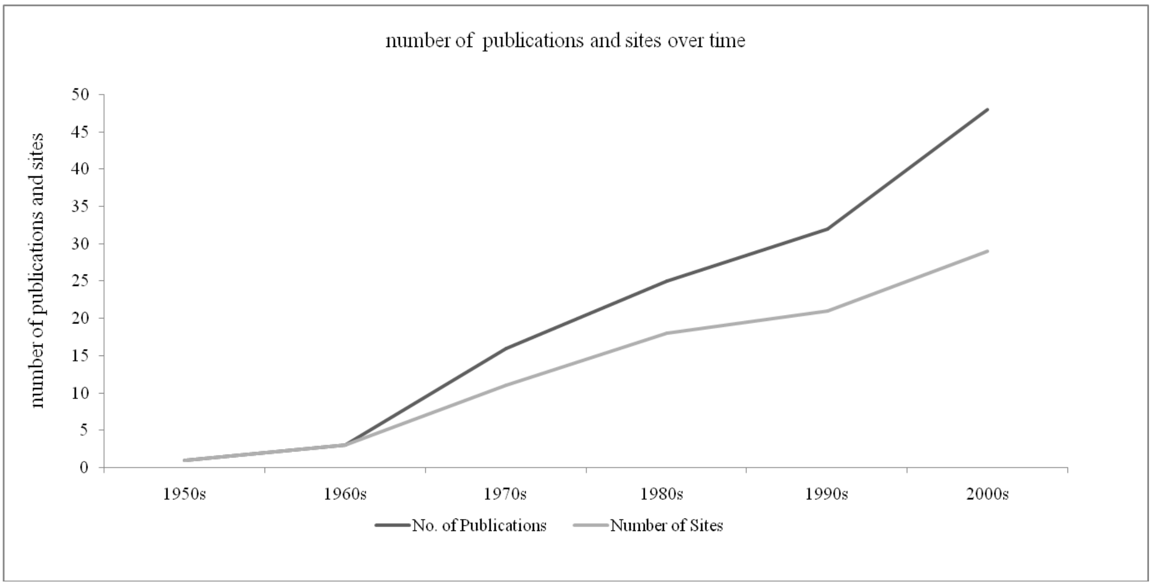
Helbaek at Deh Luran in Iran modified the technique by using a bucket flotation system, which utilized a 'wash-over' technique as opposed to a 'scoop' method (Hole *et al.* 1969; Helbaek 1969). In 1970 van Zeist published the results of material floated at Mureybet, Syria (Van Zeist 1970) and in 1972 Jarman *et al.* (1972) published a paper on the recovery of plant remains by froth flotation with trial flotation at the Bronze Age to Medieval site of The Udal in North Uist (Outer Hebrides, Scotland) and at Early Neolithic Nahal Oren in Palestine. In sum, experiments with flotation techniques began in the early 1960s and the application of flotation was rapidly adopted in the old and new worlds, and had considerable implications for all aspects of archaeobotanical research.

The archaeobotany of prehistoric Cyprus has its origins before the introduction of modern flotation techniques in the 1960s. In 1952, botanical results from Late Bronze Age Apliki-*Karamallos* were published. The charred plant material was hand-picked at the time of excavation and sent to the Department of Agriculture in Nicosia for analysis. The results included a list of plant taxa (du Plat Taylor 1952), and decades later charred specimens were used for radiocarbon dating (Kling *et al.* 2007). Additional material that was hand-picked during excavation at Apliki-*Karamallos* and not previously examined was analysed by Helbaek nearly a decade later (Helbaek 1962). Helbaek concluded from the results that there was exploitation and cultivation of locally available plant resources including bread wheat, six-row barley, lentil, and horse bean (Helbaek 1962); he was the first to interpret Cypriot prehistoric botanical data. It was Stewart (1974) who first applied modern flotation techniques in Cyprus at Dhali-*Agridhi*. This was followed by flotation at Dhali-*Agridh*i, Khirokitia-*Vounoi* (Waines and Stanley-Price 1977) and Cape Andreas-*Kastros* (van Zeist 1981).

4.5 Current Archaeobotany in Cyprus

To date there are 50 publications on the archaeobotany of Cyprus. These include site-based reports and summaries and syntheses covering sites dated to the earliest phases of island occupation to the Late Bronze Age (**Table 4.1**). The number of publications increases over time with one publication in the 1950s, two in the 1960s, 13 in the 1970s, ten in the 1980s, eight in the 1990s, and 16 since 2000 (**Figure 4.2**). There are a total of 30 sites (some with data from multiple cultural phases) in Cyprus that have archaeobotanical data, this includes the four sites analysed in this thesis. Archaeobotanical results from Aceramic Neolithic and Late Bronze Age periods are well documented but there are far fewer reports from the Ceramic Neolithic, Chalcolithic, and Early to Middle Bronze Age. There are seven sites with archaeobotanical data from the Aceramic Neolithic, three from the Ceramic Neolithic, six from the Chalcolithic, four from the Early/Middle Bronze Age, and eight from the Late Cypriot period and later.

Figure 4.2 Cumulative number of publications and number of sites in Cypriot archaeobotany with time, The darker line denotes number of publications and the lighter line indicates number of sites that have been added to the total number of sites with archaeobotanical data



In addition to the disparity in cultural phase representation there are differences in the representation of botanical data. The ‘unevenness’ in the quantity of plant specimens and the number of taxa recovered from sites has been previously highlighted (see Zohary and Hopf 2000, 247) and further discussed in studies in the origins and spread of crop-based agriculture (Colledge *et al.* 2004, S44). Many archaeologists and archaeobotanists have been responsible for implementing sampling for the recovery of archaeobotanical plant remains recorded from sites dated to the prehistoric phases of Cyprus. Thus, there is great diversity in sample size and numbers, equally varied is the care with which records have been kept since the introduction of more efficient recovery methods. Moreover, as is common elsewhere in the Near East and eastern

Mediterranean, on Cyprus there is not, nor has there been in the past, a standard methodology for the recovery of plant materials. As a result variations in excavation, sampling and archaeobotanical processing techniques have certainly contributed to differences in the taxa represented in botanical assemblages. In particular, differences in archaeobotanical recovery techniques such as hand-picked versus flotation methods, sieve size used in flotation, the number of litres per sample, and whether a microscope was used to aid in processing has directly affected the number of taxa, the quantity of charred remains, and species representation. For example, Stewart (1974) records a total of 12,090 litres sampled at Dhali-*Agridhi* and Adams and Simmonds (in Frankel *et al.* 1996, 224) record 235 total litres sampled from Marki-*Alonia*. Sample sizes have varied greatly in other regions as well, Willcox *et al.* (2008, 315) report that 12,114 litres were processed at Jerf el Ahmar, 1,520 litres at Tell ‘Abr, 6,122 at Dja’de, and 1,772 litres at Tell Qaramel. Methods of recovery, processing, and identification have also varied. Murray (2003) describes the methodology used in the analyses of material from Aceramic Neolithic Kissonerga-*Mylouthkia*; the charred remains were recovered by flotation, using both 1mm and 250 micron mesh sieves (Murray 2003, 59). By using both mesh sizes the chances of recovering very small seeded species increase. Identification was conducted with the aid of a low power microscope (Murray 2003), which helps to identify differences in morphologies that exist between genera and species. Adams and Simmons (in Frankel *et al.* 1996) give no information regarding sieve size, only that a combination of flotation and wet sieving was used at Marki-Alonia for the recovery of plant material, which was sorted without the aid of a microscope (in Frankel *et al.* 1996, 224). Taxa identified at Kissonerga-*Mylouthkia* (Colledge 2003; Murray 2003) and Marki-*Alonia* (Frankel *et al.* 1996) are likely the result of different retrieval and identification methods as well as different post-harvest processing stages. **Table 4.2** lists the recorded number of samples, volume of samples, preservation and recovery method (including details of sieve sizes used), and whether whole counts or presence only records are given and contextual information for sites discussed below.

4.6 Aceramic Neolithic

Seven flotation samples were collected from Epipalaeolithic Akrotiri-*Aetokremnos*; however, with the exception of small amounts of *Pinus* sp., *Genista*-type wood charcoal specimens no other charred material was recovered (Simmons 1999). Likewise, flotation samples from Cypro-PPNA Ayia Varvara-*Asprokremmos* are currently under analysis by the author but so far no charred material has been recovered. So, the earliest period with recorded archaeobotanical evidence is the Cypro-PPNB. Prior to this study, there were seven sites with botanical evidence for the Aceramic Neolithic of Cyprus. These sites range from the Early Cypro-PPNB to the late Pre-Pottery Neolithic/Khirokitian with a date range from about 8,500 cal. BC to 5,500 cal. BC (refer to Figure 4.1 for chronological ordering of sites). The seven sites below are discussed in decreasing order of age. The sites are Kissonerga-*Mylouthkia*, Parekklisha-*Shillourokambos,* Kalavasos-*Tenta*, Dhali-*Agridhi*, Cape Andreas-*Kastros*, Kholetria-*Ortos,* and Khirokitia-*Vounoi* . All seven sites have charred botanical remains that were recovered from flotation. The exception is Parekklisha-*Shillourokambos* which is mostly impressions in pisé with minimal charred plant remains recovered from flotation. All authors recorded the number of samples and the total volume samples, except Dhali-*Agridhi*, which the volume was not reported. The total number of samples recorded for the Aceramic Neolithic of Cyprus is 877 and the total number of litres sampled is approximately 28,208.

4.6.1 Kissonerga-*Mylouthkia*

Kissonerga-*Mylouthkia* is located on the southwest coast of the island. The site has two cultural phases, Aceramic Neolithic and Chalcolithic. A total of five radiocarbon dates show two phases of Aceramic Neolithic occupation, Phase 1A and 1B (Peltenburg 2003). Phase 1A dates to ca. 8450 cal. BC and Phase 1B dates to ca. 7150 cal. BC, with a gap of approximately a millennium between. In 2003, Murray and Colledge published the archaeobotanical results from charred remains from the 1976-1996 excavations (Colledge 2003, 239-245; Murray 2003, 59-71). Murray presents the results from the Cypro-PPNB occupation (Colledge presents the results from the Chalcolithic occupation, the latter discussed in the Chalcolithic section below).

The botanical material was preserved in charred form and recovered by flotation using both 1 mm and 250 micron mesh sieves. A total of 880 litres from 12 samples was sampled from two wells, a pit and a building fill. Five samples are from Period 1A and seven samples are from Period 1B. The botanical material includes domesticated cereal grain and chaff, legumes, wild herbaceous taxa (interpreted as potential crop weeds), fruit and oil plants, and nuts (Murray 2003, 59-71). For Phase 1A there are four domestic taxa, one oil plant, one fruit, and seven wild herbaceous taxa. The domestic taxa include *Hordeum sativum* (hereafter hulled barley) grains and chaff, *Triticum dicoccum* (hereafter emmer wheat) and *Triticum monococcum* (hereafter einkorn wheat) grains and chaff and *Lens* sp. (hereafter lentil). There is also evidence of *Linum* sp. (hereafter linseed), *Pistacia* sp. (hereafter pistachio), and seven wild herbaceous taxa. In comparison with the earlier samples, Phase 1B has one additional fruit tree, *Ficus* sp. (hereafter fig) and the following additional wild herbaceous taxa: *Adonis* sp. (hereafter pheasant's eye), *Fumaria* sp. (hereafter fumitory), *Malva* sp. (hereafter mallow), *Scorpiurus* spp. (hereafter prickly caterpillar), *Rumex* sp. (hereafter dockweed), *Polygonum* sp. (hereafter knotweed), *Hordeum* sp. (hereafter wild barley), and *Beta* sp. (hereafter beet).

The botanical data from the Aceramic Neolithic, particularly, the data recovered from Kissonerga-*Mylouthkia* 1A contributed to debates on the island's early economic development. The plant assemblage recovered from the earlier phase of the site provides evidence for a colonisation by farmers to the island at ca. 8500 cal. BC and against the argument of agricultural development by local foragers (Peltenburg *et al.* 2000). Further, the data provides evidence for agricultural continuity with the subsequent Khirokitian culture (Peltenburg *et al.* 2000), a culture that only in the 1990's was thought to have been the earliest evidence of human occupation on Cyprus. Evidence of domesticated cereals and their associated weed taxa in early Cypriot Neolithic assemblages also sheds light on the timing and direction of Near Eastern cereal crop dispersal with Cyprus being the first targeted region colonized in the early spread of Near Eastern agriculture (followed by central Anatolia and then Crete and Greece) (Colledge 2004; Colledge *et al.* 2004).

4.6.2 Parekklisha-*Shillourokambos*

Parekklisha-*Shillourokambos* is a ca. 1ha. site located 6km east of Limassol. Nine radiocarbon dates have identified two phases of Aceramic Neolithic occupation at, Phase A (Cypro-EPPNB) and Phase B (Cypro-M/LPPNB) (Guilaine 2003), with a date range between c. 8425 and 7875 calibrated BC, and an average date of ca. 8075 cal. BC (based on one standard deviation). Architectural remains include pits, wells, circular stone structures, hearths, post-hole alignments, and a trapezoidal enclosure bounded by trenches (Guilaine 2003). Willcox (2001) published the archaeobotanical results from Parekklisha-*Shillourokambos*. A total of 19 samples (2,446 litres of soil) were floated using a mesh size of 0.5 mm. However, possibly due to extremely poor preservation results are based mainly on plant impressions in pisé and only nine taxa are recorded and (Willcox 2001, 129), including wild barley grain and chaff, and indeterminate glume wheat grains and chaff and indeterminate barley grains, *Capparis spinosa* (hereafter caper), *Prunus* sp., and the following wild herbaceous taxa: fumitory, *Lathyrus* sp., and *Galium* sp. (hereafter bedstraw). The results from Parekklisha-*Shillourokambos* provide additional evidence for colonisation by famers to the island in the Cypro-PPNB. However, the archaeobotanical evidence includes wild barley grain and chaff. This has fuelled debates on whether the plant remains were a result of local agricultural developments or introduced to the island as part of a farming “package”. However, due to the paucity of plant specimens recovered from Parekklisha-*Shillourokambos* it is difficult to understand the cause of differences in data at this time (Colledge and Conolly 2007, 59).

4.6.3 Kalavasos-*Tenta*

Kalavasos-*Tenta* is located 4 km south of Kalavasos in the Larnaca district on the island’s southern coast. The site was excavated over five seasons between 1976 and 1984. A total of 19 radiocarbon dates show two phases of occupation, Aceramic Neolithic and Ceramic Neolithic (Hansen 2005, 178). Five separate phases have been assigned to the Aceramic Neolithic. The earliest phase is Period 5, which is broadly contemporary with the early levels of Parekklisha-*Shillourokambos*. Period 5 lacks substantial architecture and has stake holes and pits. Period 4 dates to ca. 7500 cal. BC and the architecture includes a site enclosure wall and ditch. Period 3 has a mud-brick building and dates to about 6950 cal. BC. The best represented phase is Period 2 and it is defined by tightly clustered curvilinear stone and mud-brick domestic structures dating to ca. 6200 cal. BC (Todd 2004). Although five phases of occupation have been assigned culturally, the calibrated radiocarbon dates range between ca. 7,600 and 5,800 cal. BC and illustrate three main phases (illustrated in Figure in 4.1 as K*Tenta* I, K*Tenta* II, and K*Tenta* III). For this discussion botanical data from Phase 4 will be represented by K*Tenta* I, Phase 3 will be represented by K*Tenta* II, and Phase 2 will be represented by K*Tenta* III.

In 2005 Hansen published the archaeobotanical results (Hansen 2005, 323-343). The material was preserved in charred form and recovered by flotation. A total of 416 samples were floated totalling approximately 7,764 litres, of which only 175 samples (2,074 litres) had identifiable remains. Samples were taken from both pits and hearths, and inside and outside of domestic structures. Hansen divides the Aceramic Neolithic samples into the following cultural phases, from latest to earliest: Periods 1 – 5. The latest and earliest phases of occupation only have specimens from the grass family and therefore, Periods 1 and 5 have been excluded from this discussion. The data from the Late Neolithic/Chalcolithic transition will be discussed below.

Plant remains from the Aceramic Neolithic occupation of Kalavasos-*Tenta* include three domesticated cereals, einkorn wheat (both one and two-grained) grains and chaff, emmer wheat grains and chaff, and hulled six-row barley grains and two domesticated pulses, lentil and *Pisum* sp. (hereafter pea). There are four tree/shrub species, caper, fig, pistachio, possibly specimens of either pear or apple and 24 wild herbaceous taxa (Hansen 2005, 232). The plant assemblage is comparative to contemporary sites with regards to the crop assemblage. However, there are considerably more wild herbaceous taxa recorded at Kalavasos-*Tenta* than for Kissonerga-*Mylouthkia* and Parekklisha-*Shillourokambos*; including charred specimens of *Ranunculus* sp., *Geranium* sp., *Astragalus* sp. *Genista* sp., *Medicago* sp., *Trifolium* sp., *Rubus* sp., *Lithospermum arvensis* (hereafter field gromwell), *Amaranthus retroflexus* (hereafter redroot pigweed), *Eleocharis* sp., *Schoenus nigricans* (hereafter black bogrush), *Scirpus sp.*, *Hordeum murinum* (wild barley), and *Phalaris canariensis* (hereafter canary grass). This possibly could be explained by the fact that the number of wild taxa species are lowest in the initial stages of colonisation (Colledge *et al.* 2004). Hansen interprets the assemblage as evidence of cereal and legume agriculture supplemented with the gathering of wild resources. Einkorn wheat is more common than emmer wheat in Period 4 (2% of total seeds versus 0.9%, correspondingly) and emmer wheat is more abundant than einkorn in Periods 2 and 3 (1% versus 0.7% total seeds). However, more evidence is needed in support of these chronology changes (Hansen 2005, 326).

4.6.4 Dhali-*Agridhi*.

Dhali-*Agridhi* is a late Aceramic Neolithic and Ceramic Neolithic inland site located east of the Troödos massif. There are five radiocarbon dates (Stager and Walker 1974, 219) that give a calibrated range between 7100-4300 BC, with Aceramic Neolithic occupation corresponding to ca. 6550 cal. BC and the Ceramic Neolithic occupation to about 4,900 cal. BC. Stewart (1974) records the findings from plant material that was preserved in charred form and was recovered by flotation from the 1972 field season. A total of 12,090 litres of soil was floated from 109 contexts, many of which contained no identifiable plant remains. There are 19 taxa from the Aceramic Neolithic occupation and two from the Ceramic Neolithic occupation (Stewart 1974, 123-129). The domesticated crops from Dhali-*Agridhi* include both naked and hulled barley, emmer wheat, free-threshing wheat, *Cicer arietinum* (hereafter chickpea), lentil, *Pisum sativum* (hereafter pea) and *Vicia sp.* (vetch). In addition to fig and pistachio there are trees that have not previously been recorded including, *Celtis* sp. (hereafter hackberry), *Olea* sp. (hereafter olive), and *Vitis* sp. (hereafter grapevine), and *Prunus domestica* (hereafter plum).

4.6.5 Cape Andreas-*Kastros*

Cape Andreas-*Kastros* is a late Aceramic Neolithic site located at the northern most tip of the Karpas peninsula. The site was excavated for four consecutive seasons from 1970-1973. Three radiocarbon dates (le Brun 1981, 71) give an average date of ca. 5850 cal. BC. In 1981, van Zeist published the botanical results from the 1973 field season. The plant remains recovered were preserved in charred form and twenty-three samples were processed using flotation. No contextual information or information on samples size is provided. The quantities are provided for each of the 21 taxa present, which includes hulled barley, glume wheat grains and chaff (emmer and einkorn wheat), lentil, pea, vetch, and *Vicia faba* (hereafter faba bean). Noteworthy is the presence of faba bean, which has not been recorded in Cypriot samples dated earlier (van Zeist 1981). Van Zeist discusses the likelihood of the presence of six-row barley but due to a high degree of fragmentation and poor preservation the assignment to species could not be made with certainty (1981, 97). However, six-row barley is possible because it is also present in the assemblages of Kalavasos-*Tenta*. Interesting is the presence of *Lolium perenne/rigidum* (hereafter ryegrass), which is a weed commonly associated with cereal cultivation. However, due to its quantity (480 grains) and ubiquity (86.9 %), van Zeist suggests the possibility of ryegrass being used as an economic resource.

4.6.6 Kholetria-*Ortos*

Kholetria-*Ortos* is located 20 km east of Paphos, western Cyprus. Six radiocarbon dates give a range between 6600 and 5000 cal. BC, with an average date ca. 6200 cal. BC (based on one standard deviation). There was little evidence for architecture at the site but ashy cultural deposits were abundant (Simmons 1994). Archaeobotanical samples were taken during the 1993-1994 excavation seasons. Results from the preliminary analysis by Hansen have not yet been published and those presented here were made available by Simmons (pers. comm.). The plant remains were preserved in charred form and recovered by flotation. A total of 1,571.8 litres of soil was floated from 40 contexts. The plant remains include the following crops: barley grains and chaff, emmer and einkorn wheat grains and chaff, lentil, pea and vetch. There is also evidence of four fruit trees and six wild herbaceous taxa. Of note is the presence of *Pyrus* sp. (hereafter pear) and gromwell, both which have not been recorded in samples dated earlier. Although, Hansen records specimens from Kalavasos-*Tenta* that could not be identified to either pear or apple (*Malus* sp.).

4.6.7 Khirokitia-*Vounoi*

Khirokitia-*Vounoi* is located 5 km from the southern coast of the island. Seventeen radiocarbon dates (Le Brun 1994, 1991) provide an average date of ca. 6150 cal. BC, based on one standard deviation. There are four published reports on archaeobotanical results from 1975-1990. The plant remains were preserved in charred form and recovered by flotation. Waines and Stanley-Price (1977) published the results from the 1975-1976 excavation seasons. A total of 2,036 litres from 17 samples was wet-sieved using a 1.6 mm mesh (1977, 281-283). The samples were taken from floors and building material, including walls and ceilings. In 1984 Miller reported the results from 27 flotation samples taken from inside and outside domestic structures from the 1977-1978 seasons. Miller records the sample sizes in litres for all but five samples, ca. 115 litres (Miller 1984, 183-188). The third report presents the data from 73 samples (355 litres) that were processed with bucket flotation using a 1mm mesh from the 1980-1981 and 1983 seasons (Hansen 2005, 327). Samples were taken from hearths, basins, between layers of rock, and structure floors (Hansen 1989, 235-250). The fourth report presents results from 141 samples (950 litres) taken from pisé and mud brick walls recovered from the 1986 and 1988-1990 seasons (Hansen 1994, 393-395). The domestic taxa include hulled barley grains and chaff, emmer wheat grains and chaff, both one-grained and two-grained einkorn wheat grains and chaff, tentative identification of free-threshing wheat, lentil, pea, and bitter vetch. Other taxa recorded include 21 wild herbaceous taxa, seven of which have not been recorded in earlier contexts, including *Trigonella* sp., *Pimpinella* sp., *Asphodelus* sp., *Muscari* sp., *Carex* sp., *Bromus* sp., and *Setaria* sp.

4.7 Ceramic Neolithic

Botanical evidence for the Ceramic Neolithic of Cyprus is limited primarily to one site, Ayios Epiktitos-*Vrysi*, with minimal data from Dhali-*Agridhi* and Kantou-*Kouphovounos*. The sites range in date from ca. 4900 cal. BC to ca. 4000 cal. BC. All three sites dated to the Ceramic Neolithic have macro remains that were preserved in charred form and recovered by flotation. However, Ayios Epiktitos-*Vrysi* is the only site with reported number of samples and volume of samples for this cultural phase and thus provides the most informative evidence for the Cypriot Ceramic Neolithic. The total number of samples reported the Ceramic Neolithic of Cyprus is 33 and the total number of litres sampled is approximately 11,115 litres.

4.7.1 Dhali-*Agridhi*

Stewart (1974) records the findings from plant material that was preserved in charred form that was recovered by flotation from the 1972 field season. Ceramic Neolithic occupation is dated to ca. 4900 cal. BC. A total of 12,090 litres of soil was floated from 109 contexts; however, it is unclear how many samples come from contexts dated to the Ceramic Neolithic. Ceramic Neolithic occupation at Dhali-*Agridhi* includes the presence of only two species, grape and lentil.

4.7.2 Kantou-*Kouphovounos*

Kantou-*Kouphovounos* is located just north of Kantou in the Limassol district, Cyprus. There are only two radiocarbon dates, with an average date ca. 4,600 cal. BC. The site was excavated by Eleni Mantzourani (University of Athens) from 1992-1999. Of the 2.05 hectares identified in survey, only 0.09 hectares was excavated during that time. The architecture includes 39 rectilinear houses, with hearths/fireplaces, platforms, benches, grinding installations, and pits. Presence records only are reported for taxa that are represented in charred form. There are no descriptions of contextual association, sample size or retrieval methods. Margariti records the presence of wheat, barley, lentil, vetch, pea, grape, and mallow (Margariti in Mantzourani 2004).

4.7.3 Ayios Epiktitos-*Vrysi*

Ayios Epiktitos-*Vrysi* is located on the northern coast of Cyprus in the Kyrenia lowlands. The site, which covers ca. 0.08 hectares, was excavated by Peltenburg from 1969-1973. Unfortunately, excavations were stopped at the beginning of 1974 due to political conflict on the island and as a result the report published in 1982 is considered to be preliminary. The site lies on uncultivated land but has been affected by erosion and development (Peltenburg 1982c). The domestic architecture consists of single-roomed rectilinear structures made of stone, pisé, and mud plaster with internal hearths. Seventeen radiocarbon dates provide evidence of three Phases of occupation (Peltenburg 1982c); early, middle and late, with a date range between 4330-4000 cal. BC and an average date of ca. 4165 cal. BC.

Kyllo (in Peltenburg 1982c) published the results of the poorly preserved charred macro remains from the 1972 field season. The samples were dry sieved with a 1 cm mesh and then the charred material was recovered from a modified froth flotation system using 2mm, 1mm and 0.5 mm mesh sieves. A total of 11,115 litres from 33 samples were processed from a series of floors, hearths, middens, and pit fills (Kyllo in Peltenburg 1982c, 90-93). A total of 50 taxa were represented at Ayios Epiktitos-*Vrysi* including both six-row and two-row hulled barley grains, one and two-grained einkorn grains, emmer wheat grains, free-threshing wheat grains, rye, pea, lentil, chickpea, and grass pea. In addition, there were seven oil/fibre/tree plants and 32 wild/weed taxa, 21 of which have not previously been recorded (**Table 4.3**).

4.8 Chalcolithic

There are six sites with charred macro remains that were recovered by flotation dated to the Cypriot Chalcolithic. These sites are Kalavasos-*Tenta*, Lemba-*Lakkous*, Kissonerga-*Mylouthkia*, Kissonerga-*Mosphilia*, Kalavasos-*Ayious*, and Prastio-*Agios Savvas.* These sites range in date from ca. 4000 cal. BC to ca. 2300 cal. BC and are assigned culturally to the Early to Late Chalcolithic. With the exception of Lemba-*Lakkous* and Kalavasos-*Ayious*, all sites have recorded number and volume of samples. The total number of samples reported for the Cypriot Chalcolithic is 366 (exclusion of unknown samples from Kalavasos-Ayious) and the total number of litres sampled is approximately 14,869 litres (with the exclusion of data from Kalavasos-*Tenta*, Lemba-*Lakkous* and Kalavasos-*Ayious*).

4.8.1 Kalavasos-*Tenta*

There are eight archaeobotanical samples that were taken from the Chalcolithic occupation at Kalavasos-*Tenta* (Hansen 2005). However, Todd (2005) cautions acceptance of the dates for this period due to possible contamination. Nevertheless, the poorly preserved charred macro remains were recovered by flotation and analysed by Hansen along with the results from Aceramic Neolithic occupation (2005). Unlike information recorded for the Aceramic Neolithic, no information regarding context or sample sizes is provided. The samples from this period contained no evidence of cereal crops only a few wild herbaceous taxa including, mallow, fumitory, and gromwell (Hansen 2005, 328).

4.8.2 Lemba-*Lakkous*

Lemba-*Lakkous* is located in Lemba village on the southwest coast of the island. Nine radiocarbon dates (Peltenburg 1985) range in date from ca. 4,700 cal. BC to ca. 2400 cal. BC and give an average date of ca. 3800 cal. BC. Colledge reports the botanical results that were poorly preserved in charred form and recovered by flotation from the

1976-1983 excavations (Colledge 1985, 297-298). Fifteen samples from burial contexts, pits, occupation levels, and fire pits were taken from Area II, which had more charred plant remains. However, the volume of the majority of samples is unrecorded. Noteworthy is the abundance of barley and the large amount of economic plant taxa recovered from burial contexts (Colledge 1985, 297). There are a total of 20 taxa including six-row hulled barley grains, free-threshing wheat grains, indeterminate free-threshing/glume wheat grains, lentil, grape, pistachio, olive, fig and 11 wild herbaceous taxa.

4.8.3 Kissonerga-*Mylouthkia*

Kissonerga-*Mylouthkia* is a multi-phase site located 5km north of Paphos on the southwest coast of the island. There are five phases of occupation dating to the Early and Middle Chalcolithic, four of which have botanical data (second, third, fourth, and final phase) (Colledge 2003, 239-245). Nine radiocarbon dates dated to Period 2 and Period 3 give an average date of 3555 cal. BC (Peltenburg 2003, 259).

The well-preserved charred plant remains were recovered by flotation. Colledge records the results from 9 samples from three pits (Pits 1, 16, and 28) with a total volume of 2,450 litres. The pits were rich in both material culture and plant remains and have been interpreted as representing areas of domestic waste disposal (Colledge 2003, 244). There was a positive correlation between both the number of taxa and the numbers of identifiable items and sample size, relating possibly to the nature of pit deposition and the greater likelihood of good preservation. Also, the density of economic plant resources and food processing debris has been interpreted as representing burnt remains from unintentional burning of storage contexts (Colledge 2003, 244). The domesticated plant taxa include rye grains, both free-threshing and glume wheat grains and chaff, six-row and two-row hulled barley grains and chaff, emmer wheat grains, chickpea, pea, bitter vetch, and lentil. In addition there are six shrub/oil/tree plants and 23 wild herbaceous taxa.

4.8.4 Kissonerga-*Mosphilia*

Kissonerga-*Mosphilia* is a multi-phase site in Kissonerga village located 5km north of Paphos on the southwest coast of the island. The site has evidence of occupation from the Aceramic Neolithic to the Early Bronze Age. Thirty radiocarbon dates from Periods 2-5 were used to define an Early, Middle, and Late Chalcolithic occupation. The radiocarbon dates give a date range between 3500-2300 cal. BC and an average date of ca. 2900 cal. BC (Peltenburg 1998).

Murray extensively reports the finds from the Chalcolithic occupation and her interpretations are summarised here (Murray 1998, 215-223). The botanical remains were preserved through charring and recovered by flotation using both a 1mm and 250 micron mesh. Samples were taken from 18 contexts: from pits, paved and unpaved surfaces, floors, hearths, ovens, graves, pot spreads, and general levels. A total of 10,881 litres of soil was processed from 306 samples, 248 of which could be confidently assigned to the Aceramic Neolithic (Period 1A), Early Chalcolithic (Period 2), Middle Chalcolithic (Period 3A and 3B), Late Chalcolithic (Period 4), and the Early Bronze Age (Philia, Period 5); however, due to ploughing and soil disturbance preservation of the charred material was poor and only one seed was recovered from Period 1A and only 10 seeds were recovered from the Period 5, Philia phase. Sixteen samples were taken from Phase 2 (Early Chalcolithic), 24 samples were taken from Phase 3A (Middle Chalcolithic), and 55 samples were taken from Phase 3B (Middle Chalcolithic). Although extensive flotation efforts are reported for all phases of occupation, the bulk of the botanical evidence comes from the 150 samples taken from Period 4, the Late Chalcolithic occupation (Murray 1998, 215-221). The economic species include emmer wheat grains and chaff, possibly einkorn wheat, free threshing wheat grains and chaff, both two-row and six-row hulled barley grains and chaff, naked barley chaff, rye, lentils, peas, chick peas, and possibly vetch and grass pea, olive, grape, pistachio, fig, hackberry, juniper, linseed/flax and caper (Murray 1998, 217). In addition, there are 63 wild herbaceous taxa, which represent 35% of the assemblage. Of note is the fact that 29 of the wild taxa do not appear in the assemblages of sites dated to earlier periods. Most of the wild herbaceous taxa are either weeds of cultivated crops or are invaders that are commonly found in cultivated areas. From the wild taxa, Murray interprets that the crops would have been sown, with a sickle blade, in the winter and harvested in the spring. Three percent of the wild herbaceous taxa are wet loving species, including species in the Cyperaceae family; possibly suggesting a shift in field location by the Late Chalcolithic (Period 4), more specifically a shift away from settlements and closer to a water resource (i.e. spring or streams and in this case near to Skotinis stream, adjacent to the site today). There is evidence of animal consumption of barley grains and other cereal crop processing wastes and evidence for the burning of animal dung burned for fuel, which subsequently was swept into the pits (Murray 1998, 220).

Similar to the Chalcolithic Kissonerga-*Mylouthkia* pits, the pit contexts sampled from Kissonerga-*Mosphilia* also contained the highest concentration of items per litre and greatest range of taxa, which is likely due to better preservation. Murray reports differences between the two main areas of the site, the Main Area and the Upper Terrace, with the latter containing higher densities of taxa likely as a result of preservation and location on site rather than a greater intensity of agricultural activity (Murray 1998, p. 219). Of note is the Pithos House (Building 3) dated to Period 4, which contained dozens of large volume storage containers and a possible olive press. This house has been interpreted as possibly the largest, long-term storage facility in Cyprus dating before the Bronze Age. However, very few botanical specimens were recovered from this building and the pithoi within it. The possibility of a liquid being stored has been suggested but the botanical evidence does not support the substance being olive oil (Murray 1998, 220). Additionally, eight samples were taken from the ceremonial area, however, due to preservation; the taxa are only briefly discussed, which include wheat, lentil, pistachio, grape, fig, mallow, bedstraw, gromwell, clover, and flax (Murray 1991, 72).

4.8.5 Kalavasos-*Ayious*

Kalavasos-*Ayious* is an Early Chalcolithic site located in the Larnaca district. Four radiocarbon dates (Todd and Croft 2004) range between 4,040 cal. BC and 3630 cal. BC, with an average date of ca. 3835 cal. BC. The botanical remains were preserved in charred form and recovered by flotation. Hansen records disappointing results due to poor preservation. The samples were taken from Pits 25 and 27 in the northwest area of the site. Hansen reports no information on sample size, quantities or densities but records the following taxa: emmer wheat, barley and lentil (Todd and Croft 2004).

4.8.6 Prastio-*Agios Savvas* Tis Karonis Monastery

Prastio-*Agios Savvas* Tis Karonis Monastery is a Middle Chalcolithic (c. 3500-2800 BC) site located in the vicinity of the ruined monastery in the deserted village of Prastion, southern Cyprus (Rupp 2000). The plant remains were preserved in charred form and recovered by flotation. A total of 1,538 litres from 28 samples were processed (Murray in Rupp 2000). The plant remains include emmer wheat, free-threshing wheat, hulled barley, lentil, fig, grape and pistachio along with 11 wild herbaceous taxa associated with the cultivation of cereal and pulse crops.

4.9 Bronze Age Occupation

There are four sites dated to the Early and Middle Cypriot Bronze Age with records of botanical data. The sites are Marki-*Alonia*, Sotira-*Kaminoudhia,* Episkopi-*Phaneromeni,* and the Middle Bronze Age Cemetery in Kalavasos Village. Based on radiocarbon dates from Marki-*Alonia* and Sotira-*Kaminoudhia* the date range is from ca. 2400 cal. BC to ca. 1700 cal. BC. The total number of samples recorded for the Early and Middle Bronze Age is 133 and the total volume recorded is approximately 549 litres.

4.9.1 Marki-*Alonia*

Marki-*Alonia* is an Early and Middle Bronze Age site located in central Cyprus, northwest of the Troödos massif. Nine radiocarbon dates (Frankel and Webb 1992) provide an average date of ca. 2125 cal. BC. The botanical remains were preserved in charred form and recovered by flotation and wet-sieving. Sorting of the material was done by hand and not with the aid of a microscope. A total of 235 litres from 52 contexts was processed from the 1991-1993 seasons (Adams and Simmons in Frankel and Webb 1996). Taxa include barley, emmer wheat, chickpea, lentil, fig, *Amygdalus communis* (hereafter almond), pistachio, olive, grape, and 18 wild herbaceous taxa; five of which have not previously been recorded including, *Oxalis sp., Galium spurium, Anthemis sp., Picris sp.* and *Solanum sp.*

4.9.2 Sotira-*Kaminoudhia*

Sotira-*Kaminoudhia* is an Early Bronze Age site in southern Cyprus. Nine radiocarbon dates (Swiny *et al.* 2003; Steel 2004) provide a calibrated date range between ca. 2460 cal. BC and ca. 2140 cal. BC, with an average date of ca. 2300 cal. BC. The plant material was preserved in charred form and recovered by flotation using both 1.5 mm and 0.5 mm sieves. Nineteen samples were taken from shallow deposits of bins and pits (Hansen in Swiny *et al.* 2003). Very few remains were recovered from the samples and Hansen attributes this to the depth of the deposits being less than a meter from the surface which increases exposure to negative taphonomic processes. The taxa include emmer wheat, grape, almond, olive, pistachio, and pear, as well as two wild herbaceous taxa, ryegrass and brome grass.

4.9.3 Middle Bronze Age Cemetery in Kalavasos Village

The Middle Bronze Age Cemetery in Kalavasos Village was excluded from the database discussed in Chapter 3 due to contamination in tomb contexts. The samples were taken from general tomb fills and inside pottery vessels excavated from tombs (Todd 1986).

4.9.4 Episkopi-*Phaneromeni*

Episkopi-*Phaneromeni* is a Middle Bronze Age site located about 14 km west of Limassol. In 1981 Carpenter published Hansen's analysis of the charred material from the 1975-1978 excavations. Sixty-two samples (2 litres each) were processed and the results are described as disappointing. No information regarding contexts was provided, however, Carpenter records the presence of barley, lentil, grape, and either apple or pear (Carpenter in Swiny 1981, p. 65).

4.10 Late Bronze Age and Beyond

As discussed in Chapter 2, the Late Bronze Age of Cyprus (ca. 1650 -1050 cal. BC) differs from earlier Cypriot cultural phases including new social and economic transformations including massive population increase with the rise of urban complexes and a more interactive foreign trade network (Steel 2004). This is a point in Cypriot prehistory that Cyprus becomes truly integrated in the broader Mediterranean interaction sphere and evidence of contact and trade in the archaeobotanical record would be expected. Therefore, I have used the data from the Cypriot Middle Bronze Age sites as an ending point for detailed comparative analysis and have combined the data from all Late Bronze Age sites for general chronological comparisons between the Late Bronze Age and everything leading up to it. There are eight sites with botanical data from the Late Bronze and later phases and there are differences in retrieval techniques used in the recovery of botanical data from these sites. There are five sites for which evidence is based on charred plant remains (at three sites charred remains were recovered by flotation, at two specimens were hand-picked) and two with botanical data based on impressions in pottery. Helbaek records a total of 43 impressions in pottery from Kalopsidha (1966, p. 124) and Hjelmqvist records impressions from mud brick, pottery and from plant remains that were preserved through mineralisation from Hala Sultan-*Tekke* (1976; 1979, 110-133). Botanical remains preserved by charring and recovered by method of flotation include those from Kalavasos-*Ayios Dhimitrios,* Maa-*Palaeokastro,* Phlamoudhi (Hansen 1989, 82-93; Miksicek 1988; Smith 2008). Two-hundred and seventy samples were taken from six seasons of excavations from Kalavasos-*Ayios Dhimitrios*. The samples were recovered from multiple deposit types including tombs, pithoi and pottery, and storage deposits in buildings. The occupation levels of the site are relatively close to the surface (within one meter), as a consequence the remains in these levels were poorly preserved (Hansen 1989,. 82-93).

A total of 18 litres were processed from nine (18 litres) samples taken from hearth and pit in the 1985 excavation season at Maa-*Palaeokastro* (Miksicek 1988). No information is recorded on sample size or recovery methods at Phlamoudhi, only that the analysis was done with a 10x magnification hand lens and without the aid of a microscope (Smith 2008). The plant remains from Apliki-*Karamallos* were preserved in charred form. The material was recovered from the contents of pots and baskets from a burnt house and from room fill deposits and burnt floors (Helbaek 1962, 171-186; Helbaek 1966, 119; du Plat Taylor 1952, 165). Plant remains from Salamis were preserved in charred form; however it is not clear whether the remains were recovered by flotation or hand excavation. There are two archaeobotanical reports, one from the

6th-5th centuries B.C and one from the 4th century B.C. (Hjelmqvist 1973; Renfrew 1970). Interestingly, there are nine tree/shrub taxa that are not previously recorded on Cyprus. These are *Citrus medica* (hereafter citron), *Corylus avellana* (hereafter hazelnut), *Ficus sycomorus* (hereafter sycamore fig), *Pinus pinea* (hereafter stone pine), *Punica granatum/Punica* sp. (hereafter pomegranate), *Quercus* sp. (hereafter oak), *Styrax officinalis* (hereafter styrax), *Ziziphus lotus,* and *Ziziphus spina-christi* (hereafter Christ's thorn jujube).

4.11 Cypriot Archaeobotanical Summary

What can be summarised from the crop and weed assemblages is that the agricultural farming package typical of the Khirokitian culture was introduced to the island at ca. 8500 cal. BC and the evidence from sites located in Cyprus illustrate differences in crop and weed assemblages over time. Studies that look at large-scale chronological and regional trends in this Cypriot dataset are few. In 1991 Hansen summarized the evidence for economic plant species from the Aceramic Neolithic to the Classical period and interpreted changes in taxa as relating to changes in subsistence (Hansen 1991, 225-236). Since then, there have been a number of sites with data that have contributed to a better understanding of the prehistoric economy of Cyprus, largely for the Aceramic Neolithic and which will be discussed here. Previous research has focused primarily on the domestication status of the early cereal crops, the timing of their introduction to the island and the regional origins of the island's colonists. Differences between sites have previously been discussed, particularly in regards to differing crop packages and cereal crop proportions (van Zeist 1981, 97; Hansen 2005, 327). Prior research on crop-based agriculture for the later cultural phases (i.e. from the Ceramic Neolithic) has focused primarily on new species introduction. This discussion includes a summary of previous interpretation with regards to the following themes; crop introduction versus indigenous crop domestication, possible origins of the Cypriot farmers, variations in crop compositions, changes of proportions of taxa over time, and estimated chronology for species introductions. However, final interpretations and conclusions, with the inclusion of the data analysed in this thesis will be presented in Chapter 7.

4.11.1 Crop introduction versus local domestication

Of the three principal founder cereal crops in the origins of agriculture in the Near East, wild barley (*Hordeum spontaneum*) is the only one that is indigenous to Cyprus and there are no historical or present-day records for *Triticum boeoticum* (einkorn wheat) or *Triticum dicoccoides* (emmer wheat) (Christodoulou 1959; Holmboe 1914; Meikle 1985; Zohary and Hopf 2000, 16-69). The key founder pulses include wild lentil (*Lens orientalis*), wild pea (*Pisum elatius* and *Pisum humile*), wild chickpea (*Cicer echinospermum* and *Cicer reticulatum*), and wild bitter vetch (*Vicia ervilia*) (Zohary and Hopf 2000, 92-120). The pulses indigenous to Cyprus are lentil and pea (Zohary and Hopf 2000, 95-105). The remaining key crop of Near Eastern agriculture discussed by Zohary and Hopf (2000) is flax (*Linum bienne*), which is an oil and fiber source and is indigenous to the island (Zohary and Hopf 2000, 126).

The issue of crop introduction versus local domestication of cereal crops was of interest as early as the late seventies (Waines and Stanley-Price 1977, 284). More recently, botanical results from Parekklisha-*Shillourokambos* and Kissonerga-*Mylouthkia* have provided somewhat contradictory evidence, as discussed briefly above. Willcox (2001, 127) reports wild barley in the earliest phase (Phase A) at Parekklisha-*Shillourokambos* with the appearance of domestic barley by the middle phase and has suggested the domestication of barley on the island. However, more recently Willcox (2003, p. 231), argues for crop introduction based on the fact that the wild ancestors of most of the plant species are not native to Cyprus (barley being the exception). Interestingly, often overlooked evidence from Dhali-*Agridhi* provides evidence, although problematic[5], of wild einkorn (identified as *Triticum boeoticum* var. *aegilopoides*; number of grains and context not provided) on the island (Stager and Walker 1989, 206). Data from Kissonerga-*Mylouthkia* (Phases 1A and 1B) demonstrates evidence of the domesticated ‘founder’ crops, grains and chaff in the early Cypriot Aceramic Neolithic, the Cypro-PPNB (Peltenburg *et al.* 2000, 2003). Peltenburg *et al.* (2000, 850) argue for crop introduction from the mainland as opposed to indigenous agricultural development during the Early PPNB in consideration of Zohary’s hypothesis of a limited number of

[5]There was not much detail reported on the identification of wild einkorn at the site. Stager and Walker (1989, p. 206) state that the “wild einkorn determination was based on the size and compressed lateral faces of the kernel”

‘domestication events’, specifically that the founder crops would have been domesticated once or at most very few times (1996, 156).

4.11.2 Origins of the island’s colonists

The origins of the Cypriot PPNB farmers have been much discussed with crop and combined crop and wild herbaceous taxa assemblages used to infer possible regionally specific mainland origins (Hansen 2001; Willcox 2003; Colledge *et al.* 2004; Colledge and Conolly 2007). However, the composition of cereal crops of sites dated to the Aceramic Neolithic of Cyprus do not point to a particular area of origin but rather demonstrate similarities with the southern Levant, the mainland Levant, in general, and southeast Anatolia (Colledge and Conolly 2007, 54; Colledge *et al.*. 2004, S47; Murray 2003, 71; Hansen 2001, 119; Willcox 2003, 237).

Regardless of the exact region of origin, the crop and associated weed assemblage were brought to the island during the PPNB; however, interestingly not all species represented in the mainland assemblages appear in the assemblages of the early Cypriot sites. Differences in the Aceramic Neolithic assemblages include the absence of chickpea, rye, and free-threshing wheat on the island (Hansen 2001; Willcox 2003, 237). However, there is tentative evidence of free-threshing wheat at Khirokitia-*Vounoi*, present in one sample (out of 131; Hansen 1994) and also at Dhali-*Agridhi*, present in two samples (out of 99) (Steward 1974; see also Colledge and Conolly 2007). Willcox (2003, 237) states that material from the later phases of the Aceramic Neolithic, from Khirokitia and Cape Andreas-*Kastros* in particular, show a divergence from mainland sites with an abundance of einkorn wheat and high frequencies of rye-grass. Interestingly, van Zeist has suggested that ryegrass was possibly used as an economic resource due to its abundance at Cape Andreas-*Kastros* (1981, 99); however, Hansen argues against this and for its presence as crop cleaning refuse or fodder (Hansen 2005, 327).

4.11.3 Changes in proportions of taxa with time

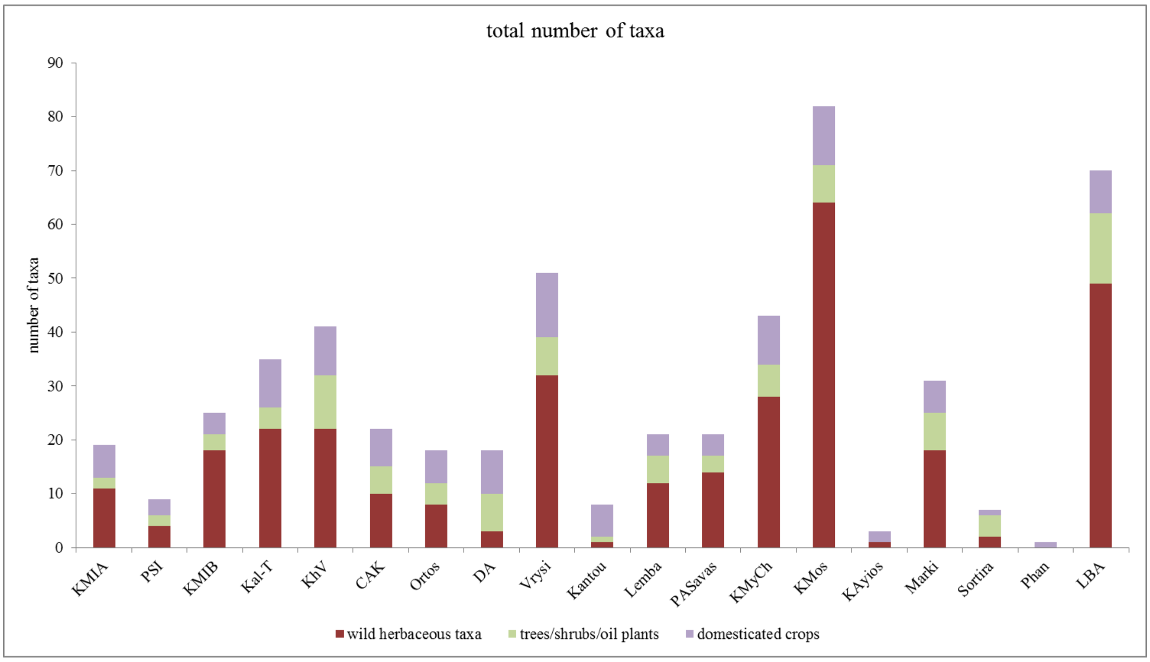
A change in the number of domestic and wild herbaceous taxa has been discussed more recently, with a general increase over time of both domestic and wild herbaceous taxa.

Colledge and Conolly (2007) present results that demonstrate an increase in wild herbaceous taxa from the Aceramic Neolithic to the Ceramic Neolithic of Cyprus, which could be explained by research that suggests the number of weed assemblages are lowest in the initial stages of colonisation (Colledge *et al.* 2004; Rösch 1998; Willerding 1986 for Central Europe; Colledge and Conolly 2007). The data not only demonstrates an increase in wild herbaceous taxa from the Aceramic Neolithic to the Ceramic Neolithic in Cyprus but from the Aceramic Neolithic to the Chalcolithic, and perhaps onwards. **Figure 4.3** illustrates the number of taxa for each site over time and for the Late Bronze Age sites combined. Noted in this bar chart is a general increase over time in the number of wild herbaceous taxa and the number of domesticated crops (i.e. cereals and legumes). In particular there is a marked increase in the number of wild herbaceous taxa from the Late Chalcolithic at Kissonerga-*Mosphilia*, Period 4.

Exceptions to this pattern of increasing taxa over time seen in **Figure 4.3** can perhaps be explained by either negative taphonomic processes and/or adverse archaeobotanical retrieval methods, including sample size, flotation method (i.e. sieve size), and identification processes (i.e. identification without the aid of a microscope). For instance, exceptions for the Aceramic Neolithic include Parekklisha-*Shillourokambos*, Dhali-*Agridhi*, Kholetria-*Ortos*, and Cape Andreas-*Kastros*. At Parekklisha-*Shillourokambos*, issues of taphonomic processes are likely the cause of the limited number of taxa as opposed to ineffective retrieval methods and sample size, which could possibility explain the limited number of taxa recovered from Dhali-*Agridhi* (Colledge and Conolly 2007, p 55-56), Cape Andreas-*Kastros*, and Kholetria-*Ortos*. Also for the Ceramic Neolithic, no information on sample size, context, or recovery methods is provided for Kantou-*Kouphovounos*. Poor preservation could explain the limited number of taxa recovered from Chalcolithic Lemba-*Lakkous* and Prastio-*Agios Savvas* (Colledge 1985; Rupp 2000). However, since all three Early/Middle Chalcolithic sites have similar numbers of wild herbaceous taxa, the possibility of a marked increase during the Late Chalcolithic (Kissonerga-*Mosphilia*) raises interesting questions particularly with regards to the cultural evidence that suggests an increasing level of external contact. For Early/Middle Bronze Age Marki-*Alonia*, small sample size, retrieval and identification methods are all possible explanations for the relatively limited number of taxa in the plant assemblage. Also, the limited data recovered from

Episkopi-*Phaneromeni* and Sotira-*Kaminoudhia* could be a result of a combination of small sample size and shallow deposits, which creates adverse preservation conditions (Hansen 2003; Carpenter 1981).

Figure 4.3 Bar chart of the total number of taxa



4.11.4 Representations of crop proportions

There are differences in crop representation amongst sites dated to the same cultural phase as well as changes over time. **Figure 4.4** is a figure of bar charts that show the difference in ubiquity (i.e. percent presence) for the domesticated wheat and barley. Emmer wheat is the most common glume wheat in all phases but decreases in incidence after the Early/Middle Chalcolithic. Free threshing wheat is rare and is mostly absent in the Aceramic Neolithic (with the exception of tentative evidence discussed above) and rare in the subsequent Ceramic Neolithic, Chalcolithic, and Bronze Age. Glume wheat is far more ubiquitous in the samples from the earlier sites, particularly one-grained einkorn and emmer wheat. All four wheats discussed (one-grained, two-grained einkorn, emmer wheat, and free-threshing wheat) are present in the Ceramic Neolithic and einkorn and free-threshing wheat decrease in the subsequent Chalcolithic. There is variation in the different author's identifications of barley, particularly in the Aceramic Neolithic; where all levels of identification are present (i.e. intermediate hulled, two- and six- row hulled, intermediate hulled/naked, naked, and wild). Of note is the percentage of naked barley, which is infrequent in all phases. The exception is the Ceramic Neolithic but this should be interpreted with caution because of the lower number of sites dated to the Ceramic Neolithic with data. The presence of lentil and chickpea is quite common and occurs in every cultural phase; however, lentil decreases in the number of sites for which it occurs after the Chalcolithic. Bitter vetch and faba bean are rare and the latter only occurs in the Late Bronze Age (**Figure 4.5**).

4.11.5 Staggered species introductions

Prior research on crop-based agriculture of the Ceramic Neolithic has focused primarily on new species introduction. Previous studies have highlighted the introduction of rye and free-threshing wheat in the Ceramic Neolithic (Hansen 1991; Colledge and Conolly 2007). In addition there is the appearance of several pulses and an increase in domestic and wild herbaceous taxa at this time (Colledge and Conolly 2007, 61). If the botanical record of the Aceramic Neolithic is truly representative of the past, new crop introductions in the later phases of the Aceramic Neolithic (Khirokitian) may include six-row hulled barley, naked barley, free-threshing wheat, chickpea, flax and the following tree species: hackberry, olive, plum, pear and grape. Ceramic Neolithic introductions may include naked barley (2-row and 6-row), grass pea, flax, and rye. Note, previous evidence of free-threshing wheat in the Aceramic Neolithic is ambiguous, as mentioned previously as is evidence of chickpea at Dhali-*Agridhi* (one specimen in one sample out of 99). Earlier evidence of flax is present in samples from Aceramic Neolithic Kissonerga-*Mylouthkia* and Cape Andreas-*Kastros*; however, the flax present in the Ayios Epiktitos-*Vrysi* sample was identified as the domesticated variety as opposed to identification at the genus level only. The Chalcolithic and Early/Middle Bronze Age do not have any new cereal or pulse crop introductions but domesticated grape likely appears in the Chalcolithic and almond in the Early/Middle Bronze. Faba bean appears for the first time in the Late Bronze Age as well multiple tree/shrub species as mentioned above, including citron, hazel, and pomegranate.

With regards to wild herbaceous taxa there is an increase over time and a number of new introductions to the record for each cultural phase, including 11 for the late Aceramic Neolithic, 18 for the Ceramic Neolithic, 32 for the Chalcolithic, four for the Early/Middle Bronze Age, and 19 for the Late Bronze Age (refer to **Table 4.4**). It is argued that the number of wild taxa is lowest in the initial phases of island colonization, during the Cypro-PPNB, and increase in diversity in later cultural phases with the establishment of agriculture (Colledge *et al.* 2004; Colledge and Conolly 2007). One proposed reason for this increase is a greater investment in agricultural fields in the initial phases of colonisation perhaps as a form of risk management (Colledge *et al.* 2004). For the later phases it is likely that a greater area of land and cultivation in new areas would have resulted in the increase in the number of wild taxa (Colledge and Conolly 2007).

Figure 4.4 Bar chart of the number of sites per phase with the presence domesticated wheat and barley

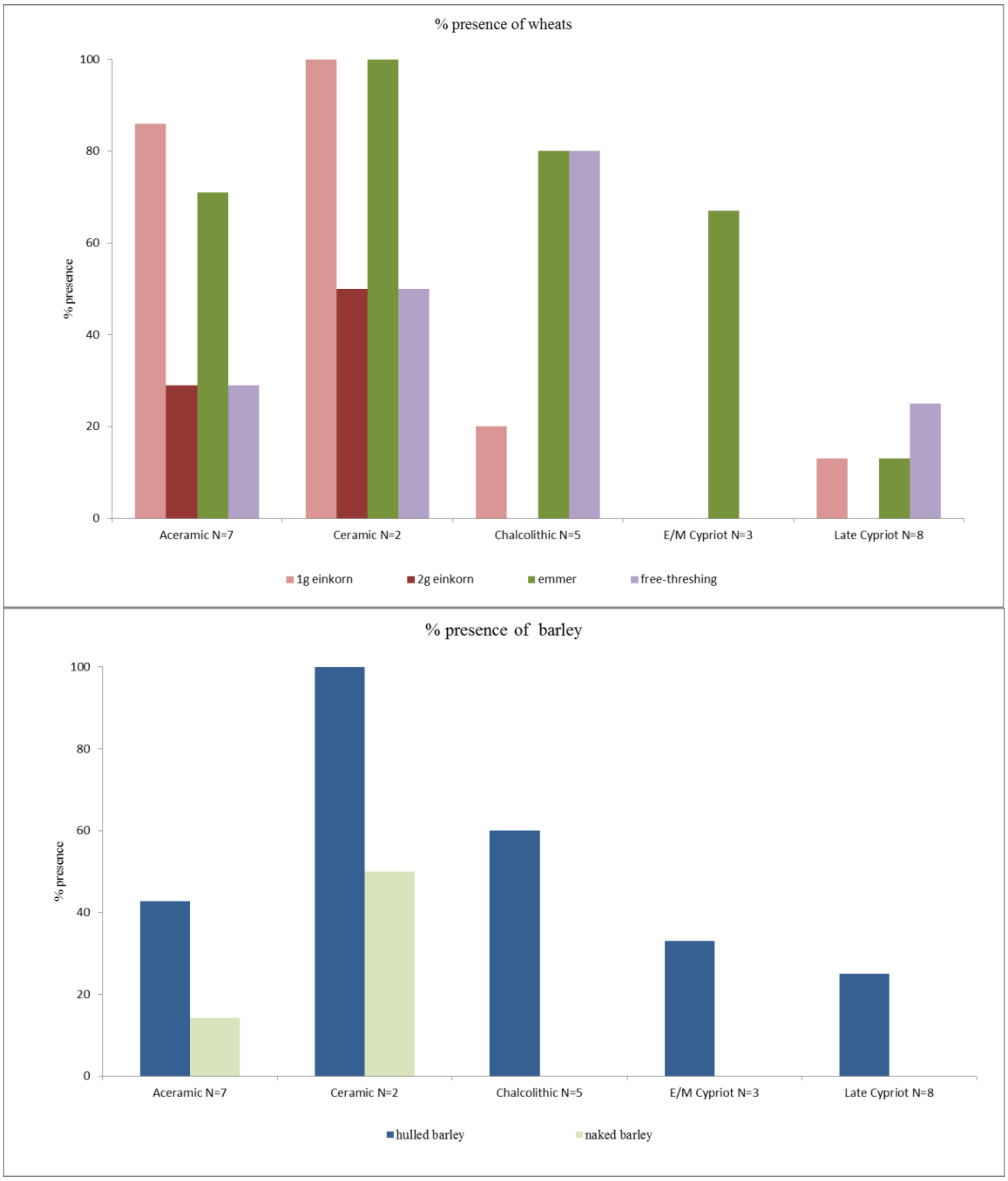


Figure 4.5 Bar chart of the number of sites per phase with the presence domesticated legumes

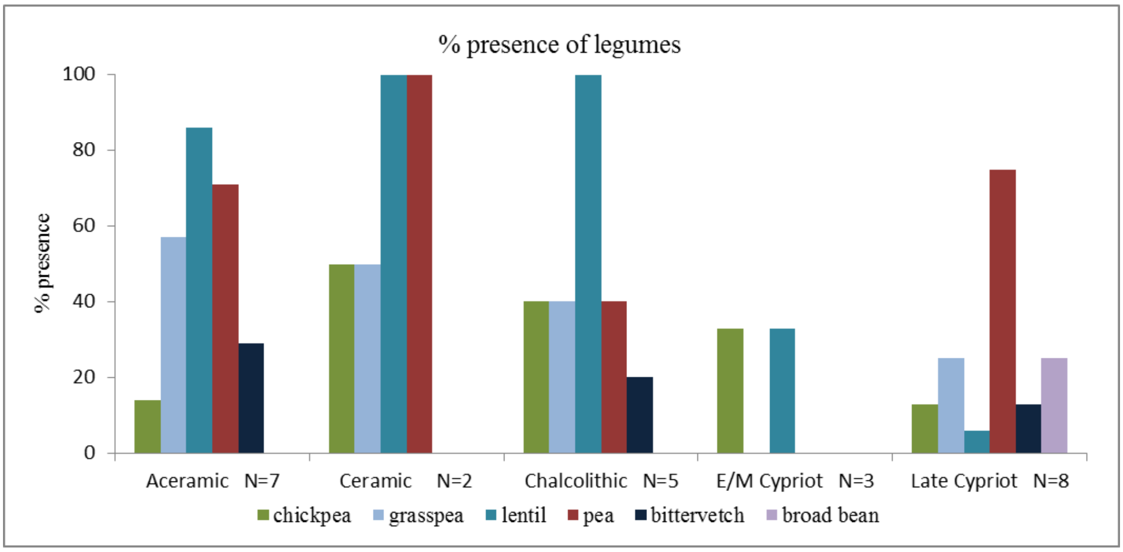


Table 4.1Cypriot Archaeobotanical Publications List

Date	Author	Phase	Site
1950s	(du Plat Taylor 1952)	Late Bronze Age	Apliki-*Karamallos*
1960s	(Helbaek 1962)	Late Bronze Age	Apliki-*Karamallos*
	(Helbaek 1966)	Late Bronze Age	Kalopsidha
1970s	Colledge (in Peltenburg 1979a)	Chalcolithic	Kissonerga-*Mylouthkia*
	Hansen (in Todd 1978)	Aceramic Neolithic	Kalavasos-*Tenta*
	Hansen (in Todd 1979)	Aceramic Neolithic	Kalavasos-*Tenta*
	(Hjelmqvist 1973)	Late Bronze Age	Salamis
	Hjelmqvist (1971)	Late Bronze Age	Enkomi
	Hjelmqvist (1971)	Late Bronze Age	Salamis
	Hjelmqvist (1977)	Late Bronze Age	Hala Sultan Tekke
	Renfrew (1970)	Late Bronze Age	Salamis
	(Stewart 1974)	Aceramic Neolithic	Dhali-*Agridhi*
	(Waines and Price 1977)	Aceramic Neolithic	Khirokitia-*Vounoi*
1980s	(Carpenter 1981)	Bronze Age	Episkopi-*Phaneromeni*
	(Colledge 1985)	Chalcolithic	Lemba-*Lakkous*
	Colledge (Peltenburg 1981)	Chalcolithic	Kissonerga-*Mylouthkia*
	(Hansen 1986)	Middle Bronze Age	Panayia Church
	(Hansen 1989)	Late Bronze Age	*Ayious Dhimitrios*
	Kyllo (Peltenburg 1982c)	Neolithic	Ayious Epiktitos-*Vrysi*
	Legge (Peltenburg 1982c)	Neolithic	Ayious Epiktitos-*Vrysi*
	(Miksicek 1988)	Late Bronze Age	Maa-Palaeokastro
	(Miller 1984)	Aceramic Neolithic	Khirokitia-*Vounoi*
	(Van Zeist 1981)	Aceramic Neolithic	Cape Andreas-*Kastros*
1990s	(Frankel and Webb 1992)	Bronze Age	Marki-*Alonia*
	(Frankel and Webb 1994)	Bronze Age	Marki-*Alonia*
	(Frankel et al. 1996)	Bronze Age	Marki-*Alonia*
	(Hansen 1991)	Aceramic Neolithic	Recent Research
	(Hansen 1994)	Aceramic Neolithic	Khirokitia-*Vounoi*
	(Le Brun 1996)	Neolithic	Le Économie de Chypre
	(Murray. M A 1991)	Chalcolithic	Kissonerga-*Mosphilia*
	Murray (Peltenburg et al. 1998)	Chalcolithic	Kissonerga-*Mosphilia*
2000s	(Peltenburg et al. 2003)	Chalcolithic	Kissonerga-*Mylouthkia*
	(Colledge 2004)	Aceramic Neolithic	Neolithic Revolution
	(Colledge and Conolly 2007)	Aceramic Neolithic	A Review and Synthesis
	(Colledge et al. 2004)	Aceramic Neolithic	Spread of Farming
	(Peltenburg et al. 2000)	Aceramic Neolithic	Colonisation
	Dammann (in Smith 2008)	Late Bronze Age	Phlamoudhi
	(Hansen 2001)	Aceramic Neolithic	Clues to their Origins
	(Swiny et al. 2003)	Early Bronze Age	Sotira-*Kaminoudhia*
	Hansen (Todd 2005)	Aceramic Neolithic	Kalavasos-*Tenta*
	Hansen (Todd and Croft 2004)	Chalcolithic	Kalavasos-*Ayious*
	(Mantzourani 2003)	Ceramic Neolithic	Kantou-*Kouphovounos*
	Murray (Rupp et al. 2000)	Chalcolithic	Prastio-*Agios Savvas*
	(Murray 2003)	Aceramic Neolithic	Kissonerga-*Mylouthkia*
	(Peltenburg et al. 2001)	Aceramic Neolithic	Colonists
	(Willcox 2001)	Aceramic Neolithic	*Shillourokambos*
	(Willcox 2003)	Aceramic Neolithic	Origins
	(Lucas *et al*. 2012)	Aceramic Neolithic	Spread of Farming

Table 4.2 Recorded number of samples, volume of samples, preservation and recovery method, whole counts provided and contextual information provided for Cypriot sites dated to Aceramic Neolithic to Middle Bronze Age ("-" denotes not known; "im.' denotes impressions; "ds" denotes dry-sieved)

site	# samples	# litres	whole counts	contexts	preservation	recovery method	mesh size
Kissonerga-*Mylouthkia* (1A/1B)	12	880	yes	yes	charred	Flotation	1mm and 250 micron
Parekklisha-*Shillourokambos*	19	2446	yes	yes	im./charred	Flotation	.5 mm
Kalavasos-*Tenta*	416	7764	yes	yes	charred	Flotation	unknown /(1mm)
Dhali-*Agridhi*	109	12,090	yes	yes	charred	Flotation	
Cape Andreas *Kastros*	23	-	yes	no	charred	Flotation	unknown
Kholetria-*Ortos* (unpublished)	40	1572	no	no	charred	Flotation	unknown
Khirokitia-*Vounoi* (total)	258	3456	yes	yes	charred	Flotation	1.6 mm, 1 mm
Kalavasos-*Tenta* Chalcolithic	8	-	-	-	charred	Flotation	unknown /(1mm)
Dhali-*Agridhi* CN	-	-	-	-	charred	Flotation	-
Ayios Epiktitos-*Vrysi*	33	11,115	yes	yes	charred	ds(1cm)/flotation	2 mm, 1 mm, .5 mm
Kantou-*Kouphovounos*	-	-	-	-	charred	Flotation	unknown
Lemba-*Lakkous*	15	-	yes	yes	charred	Flotation	unknown
Kissonerga-*Mylouthkia*	9	2,450	yes	yes	charred	Flotation	1mm and 250 micron
Kissonerga-*Mosphilia*	306	10,881	yes	yes	charred	Flotation	1mm and 250 micron
Kalavasos *Ayious*	-	10-20 l/s	no	yes	charred	Flotation	unknown
Prastio-*Agios Savvas*	28	1,538	yes	yes	charred	Flotation	1mm and 250 micron
Marki-*Alonia*	52	235	no	no	charred	Flotation	unknown/hand sorted
Sotira-*Kaminoudhia*	19	190	yes	yes	charred	Flotation	1mm and .5 mm
Episkopi-*Phaneromeni*	62	124	no	no	charred	Flotation	unknown

Table 4.3 List of taxa from sites dated to the Aceramic Neolithic to the Late Bronze Age. The data from the Late Bronze Age sites is combined. ("d" denotes domesticated; "w" denotes wild; "G" denotes glume bases; "R" denotes rachis; "RI" denotes rachis internodes; "SF" denotes spikelet fork; "" denotes "cf" classification; '-" author states identification is not reliable; "indet" denotes indeterminate; "f.th." denotes free-threshing; "1g" denotes one-grained; "2g" denotes two-grained; "T." denotes Triticum; "H." denotes Hordeum; common names for cereals, pulses, and oil/tree/shrubs provided in parentheses)*

Table 4.3		**Cypro-PPNB**					**Khirokitian**			**CN**			**Chalcolithic**				**E/M Bronze**			**LBA**
Cereals		**KMIA**	**PS**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sotira**	**Phan**	**LBA**
H. spontaneum (w barley)	G		+										+							
	R		+																	
H. spontaneum/sativum (w/d barley)	G		+																	
H. sativum (indet. hulled) (d barley)	G	+		+		+		+						+		+	+			
	RI	+		+		+		+												
H. sativum (6-row hulled) (d barley)	G					+	+-		+	+		+	+							+
	RI												+	+						
H. sativum (2-row hulled) (d barley)	G				+				+	+	+		+							
	RI												+	+						
H. sativum hulled or naked (d barley)	G																		+	+
	RI	+																		+
H. sativum (naked) (d barley)	G								+	+*										
	RI													+						
T. aestivum/durum (f.th wheat)	G												+	+						
	R												+	+						
T. aestivum/spelta (f.th wheat)	G					+*			+	+		+				+				+
T. sp. indeter. f.th./gl. wheat	G	+		+	+	+		+				+				+				
T. sp. indet. gl. wheat	GB/ SF	+	+	+									+							
T. monococcum 1g (1g einkorn)	G	+	+	+	+	+	+	+		+	+				+					
T. monococcum 2g (2g einkorn)	G				+	+				+										
T. monococcum 1g/2g	GB/ SF				+	+		+						+						

Table 4.3		**Cypro-PPNB**					**Khirokitian**			**CN**		**Chalcolithic**					**E/M Bronze**			**LBA**
Cereals		**KMIA**	**PS**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sotira**	**Phan**	**LBA**
T. monococcum/dicoccum (einkorn/emmer)	G	+		+									+	+						
	GB/ SF						+							+						
T. dicoccum/dicoccoides (emmer wheat d/w)	G		+																	
	GB/ SF		+																	
T. dicoccum (emmer wheat)	G	+		+	+	+	+	+	+	+	+		+	+	+	+	+	+		
	GB/ SF/ R				+	+		+						+			+			
T. dicoccum/spelta (emmer/f.th. wheat)	G																			+
Secale cereale (rye)	G									+			+	+						
	R													+						

Table 4.3	Cypro-PPNB						Khirokitian			CN			Chalcolithic				Sortira		LBA
Pulses and flax	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Cicer arietinum (domesticated chickpea)								+	+			+	+						+
Cicer sp. (chickpea genus)																+			
Lathyrus sativus (grass pea)									+				+						+
Lens culinaris (domesticated lentil)						+			+	+				+					+
Lens sp. (lentil genus)	+		+	+	+		+	+			+	+	+		+	+			
Pisum sativum (domesticated pea)				+		+			+				+						
Pisum sp. (pea genus)				+	+		+	+		+		+							
Vicia ervilia (bitter vetch)				+	+							+							
Vicia faba (broad bean)																			+
Vicia faba/narbonesis (broad bean/purple broad vetch)					+	+													
Vicia sp. (vetch)	+		+	+		+	+	+	+	+			+			+			
Vicia/Lathyrus spp.											+	+	+			+			
Linum bienne(flax)						+													
Linum usitatissimum (domesticated flax)									+				+						
Linum sp. (flax genus)	+		+			+						+							

Table 4.3	Cypro-PPNB						Khirokitian			CN			Chalcolithic			E/M Bronze			LBA
Trees and shrubs	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Amygdalus communis (almond)																+	+		+
Capparis spinosa (caper)		+		+	+								+			+			+
Capparis sp. (caper genus)					+							+							
Celtis australis (hackberry)									+										
Celtis sp. (hackberry genus)					+		+	+					+						
Citrus medica (citron)																			+
Corylus avellana (hazel)																			+
Ficus carica (fig)				+	+				+			+	+		+				
Ficus sycomorus (sycamore fig)																			+
Ficus sp. (fig genus)			+		+	+	+	+			+					+			
Olea europaea (domesticated olive)					+							+	+			+			
Olea sp. (olive genus)						+		+	+		+						+		
Pinus pinea (stone pine)																			+
Pistacia atlantica (pistachio)																			+
Pistacia terebinthus (pistachio)									+				+			+			
Pistacia sp. (pistachio)	+		+	+	+	+	+	+			+	+			+	+	+		
Prunus domestica (plum)					+			+											
Prunus insititia (damson plum)					+														
Prunus sp. (plum genus)		+			+			+	+										
Pyrus sp. (pear genus)							+												
Pyrus/Malus spp. (pear/apple genus)				+															
Punica granatum (pomegranate)																			+
Punica sp. (pomegranate genus)																			+
Quercus sp. (oak)																			+
Styrax officinalis (Styrax)																			+
Vitis sp. (grape genus)								+	+	+	+								

Table 4.3	Cypro-PPNB						Khirokitian				CN			Chalcolithic			E/M Bronze		LBA
Trees and shrubs	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Vitis sylvestris (wild grape)											+								
Vitis vinifera (domesticated grape)												+	+		+	+	+		
Ziziphus lotus (lotus)																			+
Ziziphus spina-christi (thorn jujube)																			+

Table 4.3	Cypro-PPNB			Khirokitian					CN	Chalcolithic						E/M Bronze			LBA
Wild herbaceous taxa	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
RANUNCULACEAE																			
Adonis dentata (toothed pheasant's eye)						+			+										
Adonis spp. (pheasant's eye)			+									+	+		+				
Ranunculus spp.				+					+										
PAPAVERECEAE																			
Fumaria densiflora													+						
Fumaria officinalis																			+
Fumaria vaillantii																			+
Fumaria spp.		+	+	+	+	+			+			+			+	+			+
Papaver dubium									+										
Papaveraceae indet.													+						
CRUCIFERAE																			
Brassica sp.													+						
Cruciferae indeterminate				+									+						+
Malcomia sp.									+										
Neslia spp.											+	+	+						+
Raphanus raphanistrum																			+
Sisymbrium sp.													+						
CAPPARACEAE																			
Cleome sp.													+						
CISTACEAE																			
Helianthermum spp.													+						
CARYOPHYLLACEAE																			
Caryophyllaceae indet.												+	+						
Gypsophila obionica									+										

Table 4.3	Cypro-PPNB			Khirokitian				CN		Chalcolithic					E/M Bronze			LBA
Wild herbaceous taxa	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Spergularia sp.													+						
MALVACEAE																			
Malva nicaensis												+							+
M. sylvestris/nicaensis						+													
Malva spp.			+	+	+				+	+		+	+		+	+			+
GERANIACEAE																			
Geranium sp.				+															
OXALIDEACEAE																			
Oxalis sp.																+			
LEGUMINOSAE																			
Astragalus spp.				+	+	+													
Coronilla scorpioides													+						
Genista sp.				+															
Lathyrus blepharicarpus																			+
Lathyrus spp.	+	+			+		+					+	+						
Leguminosae indet.				+	+	+	+				+		+		+				
large	+		+										+						
small												+	+						
Lens orientalis																			
Lupinus albus																			+
Medicago truncatula									+										
Medicago spp.				+	+	+	+	+					+			+			
Melilotus sulcata																			+
Melilotus sp.																			+
Scorpiurus muricatus									+				+						
Scorpiurus spp.			+																+
Trigonella spp.					+								+						+

Table 4.3	**Cypro-PPNB**				**Khirokitian**				**CN**	**Chalcolithic**						**E/M Bronze**			**LBA**
Wild herbaceous taxa	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Trifolium spp.				+					+				+						
Vicia cracca																			+
ROSACEAE																			
Rosa sp.																			+
Rubus sp.				+															
CUCURBITACEAE																			
Bryonia dioica																			+
Cucurbitaceae indet.																			+
UMBELLIFERAE																			
Bifora testiculata												+	+						
Boraginaceae indet.									+				+						
Bupleurum subovatum													+						
Bupleurum sp.															+				
Coriandum sativum																			+
Pimpinella sp.					+														
Umbelliferae indet.	+		+										+						
RUBIACEAE																			
Crucianella sp.									+										
Galium spurium																+			+
Galium tricornutum									+										+
Galium verum									+										
Galium spp.	+	+	+	+			+				+	+	+		+	+			+
Rubiaceae indet.													+						
Sherardia sp.												+							
VALERIANACEAE																			
Valerianella dentata													+						

Table 4.3	**Cypro-PPNB**				**Khirokitian**				**CN**			**Chalcolithic**				**E/M Bronze**			**LBA**
Wild herbaceous taxa	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Valerianella sp.												+							
COMPOSITAE																			
Anthemis sp.																+			
Arctium lappa									+										
Calendula arvensis									+										
Calendula sp.																			+
Carthamus lanatus																			+
Carthamus tinctorius																			+
Carthumus sp.																			+
Centaurea spp.									+				+			+			
Chrysanthemum coronarium															+				+
Chrysanthemum sp.													+						
Compositae indet.			+									+	+			+			
Onopordum illyricum																			+
Picris sp.																+			
Senecio sp.									+										
PLUMBAGINACEAE																			
Limonium sp.													+						
PRIMULACEAE																			
Anagallis arvensis																			+
Primulaceae indet.													+						
BORAGINACEAE																			
Alkanna sp.																			+
Anchusa sp.								+											+
Arnebia decumbens											+	+							
Buglossoides arvensis				+	+				+		+	+	+		+	+			
Buglossoides tenuiflora	+										+	+	+		+				

Table 4.3		Cypro-PPNB				Khirokitian				CN			Chalcolithic				E/M Bronze		LBA
Wild herbaceous taxa	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Buglossoides spp.							+												
Echium creticum																			+
Echium italicum																			+
Echium spp.	+				+								+		+				+
CONVOLVULACEAE																			
Cuscuta sp.													+						
SOLANACEAE																			
Hyoscyamus sp.									+										
Solanaceae indet.													+						
Solanum nigrum									+										
Solanum sp.																+			
SCROPHULARIACEAE																			
Veronica sp.									+				+						
LABIATAE																			
Ajuga chamaepitys																			+
Labiatae indeterminate													+						
Teucrium sp.													+						
PLANTAGINACEAE																			
Plantago sp.													+						
AMARANTHACEAE																			
Amaranthus retroflexus				+															
Amaranthus sp.												+							+
CHENOPODIACEAE																			
Beta vulgaris													+						
Beta sp.			+																
Camphorosma sp.																			+
Chenopodium album													+						

Table 4.3	Cypro-PPNB				Khirokitian				CN			Chalcolithic				E/M Bronze			LBA
Wild herbaceous taxa	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Chenopodiaceae indet.	+		+										+			+			
Salsola sp.													+						
Suaeda fruticosa													+						
Suaeda sp.												+							
THYMELAEACEAE																			
Thymelaea passerina													+						
EUPHORBIACEAE																			
Chrozophora sp.																			+
Euphorbia peplus													+						
Euphorbiaceae indet.															+				
Euphorbia spp.									+				+						
LILIACEAE																			
Asphodelus sp.					+											+			
Liliaceae indeterminate			+									+	+						+
Muscari sp.					+														
Onobrychis sp.													+						+
Ornithogalum sp.													+						
CYPERACEAE																			
Carex sp.					+														
Cyperus sp.									+							+			
Cyperaceae indeter.											+		+						
Eleocharis sp.				+															
Schoenus nigricans				+	+								+						+
Scirpus spp.				+															
GRAMINEAE																			
Aegilops sp.													+						
Arrenatherum elatius													+						

Table 4.3	Cypro-PPNB				Khirokitian				CN			Chalcolithic				E/M Bronze			LBA
Wild herbaceous taxa	**KMIA**	**PSI**	**KMIB**	**Kal-T**	**KhV**	**CAK**	**Ortos**	**DA**	**Vrysi**	**Kantou**	**Lemba**	**KMyCh**	**KMos**	**KAyios**	**PASavas**	**Marki**	**Sortira**	**Phan**	**LBA**
Avena sp.	+		+	+	+	+	+	+	+			+	+	+					+
Avena fatua																			+
Bromus sp.					+				+		+	+	+				+		+
Gramineae indet.	+		+	+	+	+	+				+	+			+	+			+
Echinaria sp.									+										
Eragrostis barrelieri									+										
Hordeum bulbosum													+						
Hordeum murinum				+	+														
Hordeum spp.		+	+									+	+		+				
Lolium perenne						+													
Lolium rigidum																			+
Lolium rigidum/perenne											+								
Lolium temulentum																			+
Lolium spp.	+		+	+	+		+		+			+			+		+		
Phalaris canariensis				+															
Phalaris spp.	+		+		+	+					+	+	+						
Setaria/Panicum sp.												+							
Setaria sp.					+				+				+						
Stipa sp.												+	+						
POLYGONACEAE																			
Emex spinosa									+										
Rumex spp.			+										+						
Polygonum spp.			+		+				+		+	+	+			+			

Table 4.4 List of taxa for each cultural phase that are not recorded in previous periods (excluding identification at the family level). Common names are provide for cereals, pulses, and oil/tree/shrubs ("w" denotes wild; "d" denotes domesticated; "fr.th" denotes free-threshing wheat; "gl." denotes glume wheat; "AN" denotes Aceramic Neolithic)

Table 4.4					
Cypro-PPNB	**Khirokitian (late AN)**	**Ceramic Neolithic**	**Chalcolithic**	**Early/Middle Bronze**	**Late Bronze Age**
wild barley w/d barley d barley (indet. hulled) 2-row d barley barley hulled or naked fr.th/gl. wheat one-grained einkorn two-grained einkorn einkorn/emmer wheat d/w emmer wheat emmer wheat lentil pea bitter vetch flax	6-row hulled barley naked barley fr.th. wheat chickpea d lentil w flax	rye grass pea d flax			broad bean
trees caper fig pistachio plum pear/apple	**trees** hackberry olive plum pear w grape		**trees** d grape	**trees** almond	**trees** citron hazelnut Christ's thorn lotus pomegranate oak styrax

Table 4.4 continued

Table 4.4 wild herbaceous taxa					
Cypro-PPNB	**Khirokitian**	**Ceramic Neolithic**	**Chalcolithic**	**E/M Bronze**	**Late Bronze Age**
Adonis spp./*Adonis dentate*	*Trigonella* spp.	*Papaver dubium*	*Fumaria densiflora*	*Galium spurium*	*Fumaria officinalis*
Ranunculus spp.	*Pimpinella* sp.	*Malcomia* sp.	*Brassica* sp.	*Galium tricornutum*	*Raphanus raphanistrum*
Fumaria spp.	*Anchusa* sp.	*Gypsophila obionica*	*Neslia* spp.	*Anthemis* sp.	*Lupinus* sp.
Malva spp.	*Lithospermum* sp.	*Lens orientalis*	*Sisymbrium* sp.	*Solanum* sp.	*Melilotus* sp.
M. sylvestris/nicaeensis	*Setaria* sp.	*Eragrostis barrelieri*	*Emex spinosa*		*Avena fatua*
Geranium sp.	*Teucrium* sp.	*Medicago truncatula*	*Cleome* sp.		*Vicia cracca*
Astragalus spp.	*Asphodelus* sp.	*Scorpiurus muricatus*	*Helianthermum* spp.		*Rosa* sp.
Genista sp.	*Muscari* sp.	*Crucianella* sp.	*Spergularia* sp.		*Coriandum sativum*
Lathyrus spp.	*Carex* sp.	*Galium verum*	*Malva nicaensis*		*Calendula* sp.
Medicago spp.	*Bromus* sp.	*Arctium lappa*	*Coronilla scorpioides*		*Carthumus* sp./*C. tenuis*
Scorpiurus spp.	*Lolium perenne*	*Calendula arvensis*	*Bifora testiculata*		*Onopordum Illyricum*
Trifolium spp.		*Centaurea* spp.	*Bupleurum/ B. subovatum*		*Anagallis arvensis*
Rubus sp.		*Senecio* sp.	*Sherardia* sp.		*Alkanna* sp.
Galium spp.		*Hyoscyamus* sp.	*Valerianella/ V. dentate*		*L. apulum/L. officinale*
B. arvensis/tenuiflora		*Solanum nigrum*	*Chrysanthemum coronarium*		*Ajuga chamaepitys*
Echuim spp.		*Veronica* sp.	*Arnebia decumbens*		*Camphorosma* sp.
Amaranthus retroflexus		*Cyperus* sp.	*Cuscuta* sp.		*Chrozophora* sp.
Beta sp.		*Echinaria* sp.	Solanaceae indet.		*Lolium temulentum*
Euphorbia helioscopia			*Plantago* sp.		*Lolium rigidum*
Eleocharis sp.			*Amaranthus* sp.		
Schoenus nigricans			*Beta vulgaris*		
Scirpus spp.			*Chenopodium album*		
Avena sp.			*Salsola* sp.		
Hordeum spp./*H. murinum*			*Suaeda/ S. fruticosa*		
Lolium spp.			*Thymelaea passerine*		
Phalaris spp./*P. canariensis*			*Euphorbia* spp. (*peplus*)		
Rumex spp.			*Onobrychis* sp.		
Polygonum spp.			*Ornithogalum* sp.		
Stipa sp.			*Aegilops* sp.		
.			*Arrenatherum elatius*		
			Setaria/Panicum sp.		
			Hordeum bulbosum		

Chapter 5

Identification of Archaeobotanical Material from four prehistoric sites in Cyprus

5.1 Introduction

In this chapter the results of the analyses of the botanical material recovered from Krittou Marottou-'*Ais Yiorkis*, Prastion-*Mesorotsos*, Souskiou-*Laona,* and Kissonerga-*Skalia*, 2005-2010, are presented[6]. These sites were described in Chapter 3 and, as noted, represent a diachronic set of sites from the southwest of Cyprus. As outlined in Chapter 1 the two following questions are to be addressed in this chapter: Are there differences or similarities in the plant material between samples or context types? And what plant species are present in the samples? Unfortunately it was not possible to make comparisons of plant data between samples and context types for each site due to poor preservation and the paucity of plant remains recovered. Discussions of the possible explanations for this are presented in section 5.6. As a result of the limitations to the data recovered from these sites it was decided to address issues at a more general level and to consider agricultural practices on an island-based level. This discussion will be presented in Chapters 6 and 7 where the data that are presented in this chapter have been added to the Cypriot dataset and used to address the research questions with regards to regionalism and chronological change over time. This chapter will therefore focus strictly on presenting the results of botanical remains from each site in chronological order, followed by a discussion of plant remains recovery from archaeological sites and the possible explanations for differences between the quality and quantities of charred botanical material from sites located in Cyprus. These data are then compared to sites located in the mainland Levant.

5.2 Krittou Marottou-'*Ais Yiorkis*

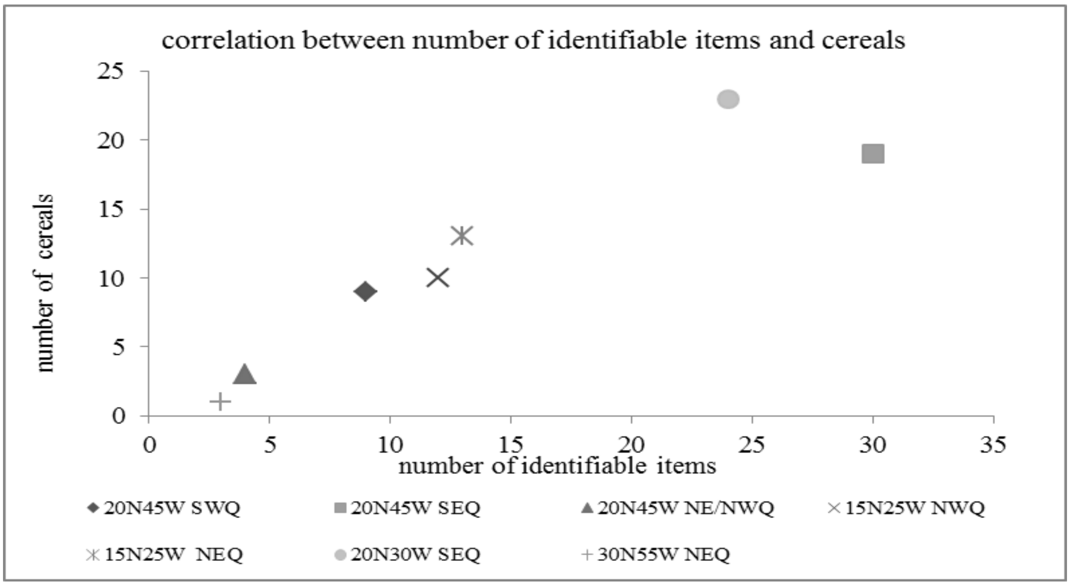
5.2.1 The samples and context types

A total of 42 samples were processed from pit fills and surfaces of circular platform structures at Krittou Marottou-'*Ais Yiorkis*. The volume of each sample, the number of charred items per sample, the number of taxa per sample, the number of items per litre, and the number of cereals per litre are listed in **Table 5.1**. Thirty samples produced no identifiable macro-remains, the maximum number of items per litre was 4.62 and maximum number of cereals per litre was 3.43. The sample with the greatest density in both items and cereal grains was SFN 28 (i.e. sample find number assigned by site

[6] At the time of writing there were additional samples still to be analysed from the 2011 and 2012 excavation seasons from Souskiou-*Laona*, Kissonerga-*Skalia* and Prastion-*Mesorotsos*.

director), which was taken from the lowest fill level of a large pit, Feature 4. This sample contained 739 items and four taxa (e.g., species, genera). SFN 37, also a fill level within Feature 4, had seven taxa and this was the greatest number per sample overall. **Figure 5.1** is a scatter gram plot that shows the correlation between the number of identifiable items and the number of cereal grains. The plot shows that there was a positive correlation between the number of identifiable items and the number of cereals. Thus, there was a greater representation of cereals in samples with larger numbers of identifiable items**;** however the samples with the largest number of different species/taxa were not the samples with the greatest number of items (e.g., SFN 37, 7 taxa and 126 items).

Figure 5.1 Correlation between number of identifiable items and the number of cereals (excluding data from Unit 20N40W, which had 1,257 items and 1,230 cereals), Krittou Marottou-'Ais Yiorkis



The majority of the plant assemblage came from one particular feature within unit 20N40W SWQ, Feature 4. Samples 28, 32, 37, 43, and 46 in Feature 4 produced the greatest densities of items, including cereals. The feature was described as an oval pit containing large quantities of chipped stone and faunal remains. The total number of identifiable plant specimens from the pit was 1,255. This accounted for 90.3% of the total number of identifiable items recovered from the entire site. Further, a total of 1,213 cereal remains were recovered from this pit. This represented 93.9% of the total number of cereals recovered from the entire site. The plant remains were likely to have been charred unintentionally and then discarded into the pit, possibly as a result of cleaning of a hearth. It is probable that the charred plant remains were the result of one or very few depositional episodes. The specimens recovered from Feature 4 were in good condition, which was probably a result of the nature of preservation of pit deposits. On the basis of comparative data from pit contexts it has been shown that pit contexts protect the specimens from destructive processes including trampling. Accordingly, the plant remains preserve with less fragmentation than if they were deposited in habitation areas (e.g. building floors) (Colledge 2003, 244). A discussion of preservation of different context types sampled in Cyprus will be presented in more detail below.

5.2.2 The plant remains

Table 5.2 is a list of the taxa from samples with identifiable material from Krittou Marottou-'*Ais Yiorkis* and in **Table 5.3** the taxa are separated into eight units, the total numbers of plant items in each SFN are presented, together with densities per litre and ubiquities for each taxon. All units contained identifiable material. A majority (57%) of the 42 samples had identifiable plant remains, which is equivalent to 70% of the total volume (3,084 L) of sediments floated. A total of 17 taxa were identified in the samples that comprised charred grains and seeds, chaff, and nutshell fragments. Although the quantity of material was relatively small, the preservation of the charred specimens was fairly good and it was possible to identify most of the specimens to species, genus, or family level.

Cereals were the most abundant taxa in the assemblage and consisted of einkorn wheat grain and chaff and barley grains. There were a total of 1,333 whole cereal grains and 17 glume bases. Out of the 1,333 cereal grains, 922 cereal grains (69.2%) were unidentifiable to genus or species and were classified as 'cereal indeterminate.' There are two morphologically distinct varieties of einkorn wheat: one-grained einkorn (e.g., one grain per spikelet) and two-grained einkorn (e.g., two grains per spikelet) (Zohary and Hopf 2000). Both varieties were recorded in the samples. Two-grained einkorn was present in 100% of the units and was recorded in 44.2% of the samples. It was the most abundant species represented at the site, with a total of 328 whole grains. This represented 79.8% of the total identifiable cereal assemblage. There was only one grain of one-grained einkorn. Einkorn wheat chaff was rare at the site and there were only 17 glume bases in SFN 32. The presence of hulled barley was not as common as einkorn wheat. There were a total of 65 whole grains of hulled barley present in 11.6% of the samples. *Hordeum sativum* has been used here to refer to cultivated hulled barley (indeterminate 2-row / 6-row). To establish whether 6-row barley is present (and in the absence of rachis remains) it is necessary to assess the symmetry or asymmetry of the grains: if asymmetrical grains were identified the possibility of grains from both the six-rowed variety and the two-row variety would be likely; at Krittou Marottou-*'Ais Yiorkis* it was not possible. It is, therefore, possible that the 65 grains were from the two-rowed hulled variety.

With the exception of lentil, all pulses were too poorly preserved to identify to genus and a distinction was not made between the wild and domesticated varieties since the two are morphologically similar (Zohary and Hopf 2000, 95). There were a total of ten specimens that were identified as *Pisum / Vicia* sp., cf. *Pisum* sp. (pea), *Vicia / Lathyrus* sp. (vetch/grass pea), *Vicia* sp., or *Lens* sp. (lentil). Two tree taxa were identified in the samples: *Olea* sp. (olive) and *Pistacia* sp. (pistachio). Since the site dates to the Aceramic Neolithic it is likely that any olive exploitation at this time was from trees of the wild variety. There were two fragments of pistachio in the assemblage but due to fragmentation and quantity, no attempt was made to identify to species.

There were a total of eight wild herbaceous taxa present in the assemblage. Unfortunately not all specimens could be identified to species or genus and subsequently these were relegated to either 'cf.' genus or family level (i.e. Leguminosae). The wild taxa included *Lolium* sp. (ryegrass), *Avena* sp. (oat), *Bolboschoenus* cf. *glaucus* (sea clubrush), *Brassica/Sinapis* spp. (mustard), *Stipa* sp. (feather grass), *Bromus* sp. (brome grass), *Malva* sp. (mallow), and fragments identified to Leguminosae (legume family). Ryegrass, oat, brome grass, and mallow are weeds associated with cereal cultivation and are common in the Cypriot archaeobotanical record. Feather grass is commonly associated with waste and fallow lands and can also be found on dry, rocky hillsides and pastures (Meikle 1985, 1790-1793).

5.2.3 Discussion of results, Krittou Marottou-'*Ais Yiorkis*

In summary, a total of 17 taxa were identified in the samples that comprised charred grains/seeds, chaff, and nutshell fragments. The assemblage included three cereal taxa: one-grained einkorn, two-grained einkorn, and two-row hulled barley; four pulses: lentil and possibly pea, vetch and grass pea; two fruit trees: pistachio and olive; and eight wild/weed taxa most of which are associated with the cultivation of cereal and pulse crops. The charred plant assemblage was dominated by two-grained einkorn wheat. The presence of two-grained einkorn on the island at this time has contributed to discussions on the spread of agriculture to Cyprus, particularly with regards to the timing of the introduction and the possible origins of the farming populations (Lucas *et al.* 2012). Prior to the Cypro-PPNB period at Krittou Marottou-*'Ais Yiorkis*, there is no evidence for two-grained einkorn on the island. There is limited evidence for the cereal in the subsequent Khirokitian period at Khirokitia-*Vounoi* and Kalavasos-*Tenta* and in the Ceramic Neolithic at Ayios Epiktitos-*Vrysi*. However the ubiquities of the two-grained variety are considerably lower in comparison to the one-grained variety at these sites (0.36%, 0.01%, and 18%, respectively) (Lucas *et al.*2012). The evidence of two-grained einkorn at this site is suggestive of a separate importation of cereal crops to the island during the Cypro-middle to late PPNB. The first importation event has been discussed by Willcox (2003) as the result of the first wave of crop expansion from southeast Anatolia. This includes the introduction of one-grained einkorn, emmer, and barley. Colledge *et al.* (2004) suggests an introduction of these species from the southern Levant by considering the evidence from both cereal crops and arable weed assemblages. However, the combination of cereals present in the Krittou Marottou-*'Ais Yiorkis* samples suggests yet an additional importation event, but of another cereal crop (two-grained einkorn wheat) and from a different region, the Syrian Middle Euphrates (Lucas *et al.* 2012). The evidence contributes to discussions of the spread of farming to the island and it highlights the complexity of this transmission. This is discussed more fully in Chapter 7.

There was very little evidence of crop processing at the site. Based on high glume base and weed to grain ratios, low number of cereal grains per litre and high ubiquity of weed taxa, Murray (2003, 64) concludes that the botanical assemblage from the contemporary (Cypro-PPNB) Kissonerga-*Mylouthkia* 1A and 1B levels are the result of fine sieving by-products and crop processing including winnowing, sieving and hand sorting. The density of wheat grains per litre at Kissonerga-*Mylouthkia* 1A and 1B is 0.1. In contrast the mean value at Krittou Marottou-*'Ais Yiorkis* is 0.41. At Kissonerga-*Mylouthkia* the weed taxa represented 52% of the assemblage with 100% ubiquity, although the numbers per samples were low. The wild/weed taxa present in the samples at Krittou Marottou-*'Ais Yiorkis* represented 0.02% of the total assemblage and were present in 0.14% of the samples. This is in opposition to the evidence from the Kissonerga-*Mylouthkia* samples. It is possible, therefore, that at Krittou Marottou-*'Ais Yiorkis* either crop processing (i.e. winnowing and sieving) was carried out away from the site or the remains of processing were deposited in a context that was not sampled, or the material did not survive due to depositional or post-depositional destructive processes. The plant remains recovered from Krittou Marottou-*'Ais Yiorkis* are likely the result of fine sieving or cleaned (sieved) crop. This is likely to include cereal grains along with larger weeds that are similar in size and as a result more difficult to separate (e.g. *Bromus* sp., *Stipa* sp., *Lolium* sp., and *Avena* sp.), which is what the evidence at this site suggests. Bogaard *et al.* (2005) highlight the potential problems of using fine sieved products to discuss crop-sowing times due to the potential bias towards autumn sowing in sieved products (larger weed species) and spring sowing (smaller seeds) in the by-products. **Figure 5.2** is a bar chart of the genera of wild arable weeds in the samples. The flowering times of each of the species from each genus are according to those given in the *Flora of Cyprus* (Meikle 1977, 1985). In this chart each y-axis unit per month represents the flowering time of a species in a genus that is represented at the site; for example, for the month of April there were 38 species within the six genera that flower in that month. For a table of flowering times of arable weeds recovered from Cypriot archaeological contexts and presented in this thesis, refer to **Appendix 2**. As shown, the majority of the species are early (January-March) and intermediate (April-June) flowering, which has been associated with autumn-sown crops (Bogaard *et al.* 2001). This adheres to the bias associated with cleaned (sieve) products, which is indicative of autumn-sowing. Further, flowering times of the arable weeds from Kissonerga-*Mylouthkia* 1A and 1B (**Figure 5.3**), another Cypro-PPNB site, illustrates a similar pattern. Thus, the weed evidence from both fine-sieved by-products and cleaned (sieved) grain from the Cypro-PPNB supports sowing of crops in the autumn. This will be dealt with in more detail and with a comparison of the all the Cypriot arable weed data in Chapters 6 and 7.

Figure 5.2 Bar chart of the flowering time of the different arable weeds from Krittou Marottou-'Ais Yiorkis samples. For an explanation of how this was calculated refer to section 5.2.3.

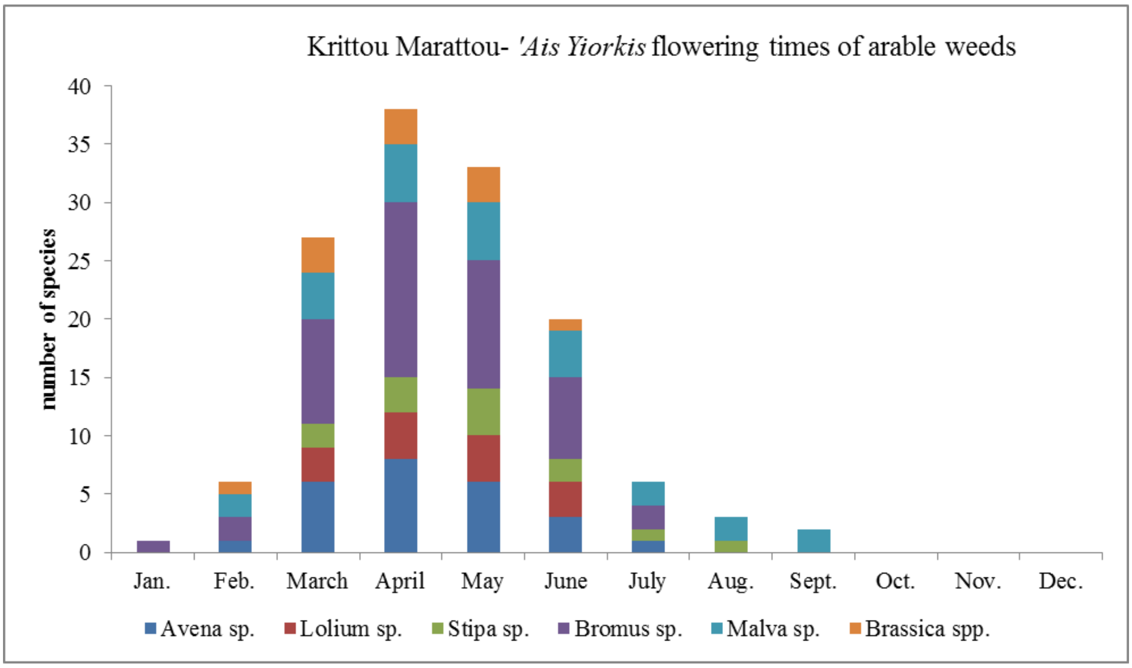


Figure 5.3 Bar chart of the flowering time of the different arable weeds from Cypro-PPNB Kissonerga-Mylouthkia samples. For an explanation of how this was calculated refer to section 5.2.3.

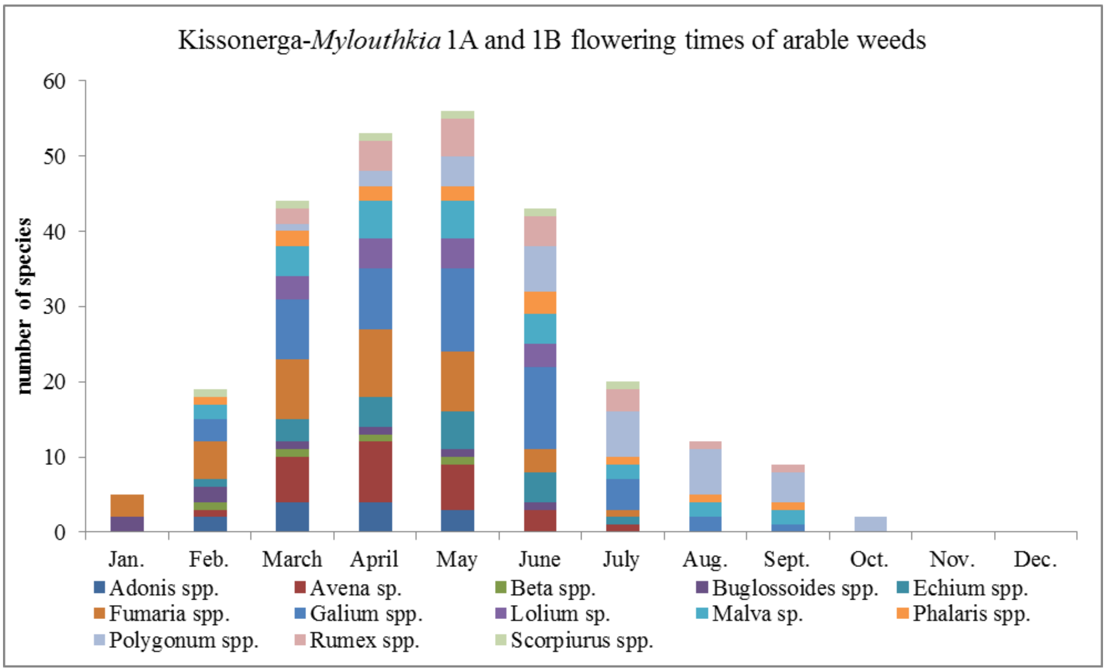


Table 5.1 Densities of the plant remains from Krittou Marottou-'Ais Yiorkis including volume of each sample, number of items per sample, number of taxa per sample, number of items per litre, and number of cereals per litre

AY	context	vol. (l)	#items	#taxa	items/l	cereals/l
SFN28	**20N40W SWQ LV6 F4.1**	160	739	4	4.62	3.43
SFN43	**20N40W SWQ LV6 4W**	110	59	2	0.54	0.37
SFN32	**20N40W SWQ LV7 F4.2**	160	292	6	1.83	1.08
SFN37	**20N40W SWQ LV8 F4.3**	150	126	7	0.84	0.65
SFN46	**20N40W SWQ LV7 F4.2W**	50	39	2	0.78	0.56
SFN51	**20N40W SWQ LV9 F4.4**	25	2	0	0.08	0.08
SFN49	**20N40W SWQ 8 F4.3W**	25	0	0	0	0
SFN105	**20N45W NE/WQ LV 9.3 F9**	08	0	0	0	0
SFN107	**20N40W LV 24.1**	20	0	0	0	0
SFN48	**20N45W SWQ LV9.2 F9.2W**	48	3	0	0.06	0.06
SFN56	**20N45W SWQ LV10.2 F10**	20	4	1	0.2	0.15
SFN57	**20N45W SWQ LV2 F13.1**	75	2	0	0.03	0.03
SFN65	**20N45W SEQ F 13.1/ 13.2**	27	6	4	0.22	0
SFN67	**20N45W SEQ LV4.4**	200	4	2	0.02	0
SFN68	**20N45W SEQ LV4.5**	350	10	2	0.03	0.01
SFN70	**20N45W SEQ LV4.6**	140	5	3	0.04	0
SFN71	**20N45W SEQ LV4.6 F8**	30	2	1	0.07	0
SFN72	**20N45W SEQ LV4.7**	100	1	1	0.01	0
SFN79	**20N45W SEQ LV4.10**	140	2	2	0.01	0
SFN80	**20N45W SEQ LV 4.11**	40	0	0	0	0
SFN82	**20N45W NE/NWQ LV9.1**	60	2	1	0.03	0
SFN99	**20N45W NE/WQ LV9.2 F9**	20	1	1	0.05	0
SFN103	**20N45W NE/WQ LV9.2 F9**	20	1	1	0.05	0
SFN101	**20N45W NE/WQ LV 9.1 F9**	20	0	0	0	0
SFN105	**20N45W NE/WQ LV 9.3 F9**	8	0	0	0	0
SFN66	**20N45W SEQ lv 13.3**	50	0	0	0	0
SFN74	**20N45W SEQ LV 4.8**	80	0	0	0	0
SFN77	**20N45W SEQ LV 4.9**	100	0	0	0	0
SFN53	**15N25W NWQ LV11.2 F11**	50	12	3	0.24	0.1
SFN58	**15N25W NEQ9**	60	13	1	0.22	0.17
SFN31	**15N25W NEQ**	15	0	0	0	0
SFN33	**15N25W NEQ F10**	50	0	0	0	0
SFN34	**15N25W NEQ F10**	100	0	0	0	0
SFN75	**15N45W SEQ LV 6**	40	0	0	0	0
SFN81	**15N25W SEQ NW SQ. LV 7**	35	0	0	0	0
SFN111	**15N25W SWQ SESubQ**	100	0	0	0	0
SFN69	**20N30W SEQ LV12.3**	53	1	1	0.02	0
SFN83	**20N30W SEQ LV3**	55	66	2	1.2	0.09
SFN42	**20N35W SEQ F7.3**	50	0	0	0	0
SFN85	**30N50W NWQ LV 19.2 F19**	20	0	0	0	0
SFN112	**30N50W NEQ**	100	0	0	0	0
SFN102	**30N55W NEQ LV22.1 F22**	60	3	2	0.05	0
SFN104	**30N55W NEQ LV 22.2 F22**	60	0	0	0	0

*Table 5.2 List of taxa from Krittou Marottou-‘Ais Yiorkis samples with identifiable plant remains (‘*cf.*’ denotes most similar to; ‘wge’ denotes whole grain equivalent; ‘ub’ denotes ubiquity; ‘gb’ denotes glume bases)*

‘Ais Yiorkis	**ub.**	**SFN total**	**28**	**32**	**37**	**43**	**46**	**48**	**51**	**53**	**56**	**57**	**58**	**65**	**67**	**68**	**69**	**70**	**71**	**72**	**79**	**82**	**83**	**99**	**102**	**103**
Cereals																										
T. monococcum 2g	44.2	328	119	76	19	17	10	-	-	5	1	-	3	1	3	4	1	3	2	1	-	2	59	-	1	1
T. cf. *monococcum* 2g	2.3	17	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. monococcum 1g	2.3	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. *monococcum* (gb)	2.3	17	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sativum	11.6	65	45	14	4	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cereal indet. (wge)	30.2	922	548	173	97	41	28	3	2	5	3	2	10	-	-	5	-	-	-	-	-	-	5	-	-	-
Pulses/Oil plants																										
Pisum/Vicia sp.	6.9	3	-	1	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
cf. *Pisum sp.*	2.3	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Vicia/Lathyrus sp.	4.7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-
cf. *Vicia sp.*	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Lens sp.	6.9	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	1	-	-	-
Trees and shrubs																										
Pistacia sp.	4.7	2	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Olea europaea	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Wild herbaceous taxa																										
cf. *Brassica/Sinapis*	2.3	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cf. *Malva sp.*	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Leguminosae (large)	4.7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-
B. cf. *maritimus*	2.3	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avena sp.	6.9	8	5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cf. *Bromus sp.*	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Lolium sp.	4.7	12	5	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stipa sp.	2.3	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 5.3 List of taxa from Krittou Marottou-'Ais Yiorkis based on unit/context ('cf.'* denotes most similar to; 'wge' denotes whole grain equivalent; 'ub.' denotes ubiquity; 'gb' denotes glume bases)*

'Ais Yiorkis		**20N40W SWQ**	**20N45W SWQ**	**20N45W SEQ**	**20N45W NE/NWQ**	**15N25W NWQ**	**15N25W NEQ**	**20N30W SEQ**	**30N55W NEQ**
Volume (L)		655	143	987	100	50	60	108	60
Items per Liter		1.92	0.063	0.03	0.04	0.24	0.216	0.212	0.05
Cereals per Liter		1.88	0.063	0.019	0.03	0.2	0.216	0.212	0.016
Total Number of Taxa		9	1	9	2	3	1	1	2
Total Number of Taxa Per L	**ub.**	.0137	.007	.009	.02	.06	.016	.009	.033
Triticum monococcum 2g	100	241	1	14	3	5	3	60	1
Triticum cf. *monococcum* 2g	12.5	17	-	-	-	-	-	-	-
Triticum monococcum 1g	12.5	1	-	-	-	-	-	-	-
Triticum cf. *monococcum* (gb)	12.5	17	-	-	-	-	-	-	-
Hordeum sativum	12.5	65	-	-	-	-	-	-	-
Cereal indeterminate (wge)	75	889	8	5	-	5	10	15	-
Total cereals	100	1213	9	19	3	10	13	23	1
Pisum/Vicia sp.	25	2	-	1	-	-	-	-	-
cf. *Pisum* sp.	12.5	-	-	1	-	-	-	-	-
Vicia/Lathyrus sp.	25	-	-	1	1	-	-	-	-
cf. *Vicia* sp.	12.5	-	-	1	-	-	-	-	-
Lens sp.	12.5	-	-	3	-	-	-	-	-
Pistacia sp.	25	1	-	-	-	1	-	-	-
Olea europaea	12.5	-	-	1	-	-	-	-	-
cf. *Brassica/Sinapis*	12.5	1	-	-	-	-	-	-	-
cf. *Malva* sp.	12.5	-	-	-	-	-	-	1	-
Leguminosae (large)	25	-	-	1	-	-	-	-	2
Bolboschoenus cf. *glaucus*	12.5	1	-	-	-	-	-	-	-
Avena sp.	12.5	8	-	-	-	-	-	-	-
cf. *Bromus* sp.	12.5	-	-	1	-	-	-	-	-
Lolium sp.	12.5	12	-	-	-	-	-	-	-
Stipa sp.	12.5	-	-	-		1	-	-	-

5.3 Prastion-*Mesorotsos*

5.3.1 The samples and context types

This section includes an analysis of a selection of samples taken from Areas V and VI at Prastion-*Mesorotsos*, both of which contained very small quantities of identifiable charred plant material. A total of 136 specimens were identified and these comprised charred grains/seeds, nutshell, and nutshell fragments. Preservation of the charred plant material was quite poor and as a result it was not possible to identify many of the specimens to species; however a majority of the specimens could be identified to either genus or family level. It was only possible to include a small proportion in this thesis because they were given to the author at a later stage of her research. Though excavations at the site continue and analysis of all the samples is ongoing. Presented here and included in the comparative analysis in Chapter 6 are preliminary results from 19 samples and 980 litres.

5.3.2 The plant remains

In **Table 5.4** the samples analysed, the volume of the samples, the number of items per sample, the total number of taxa per sample, and the densities (e.g., number of items per litre, total number of cereals per litre are presented. In **Table 5.5** a list of taxa from samples with identifiable material from Areas V and VI are provided. A total of 17 taxa were identified in the samples, which comprised charred grains/seeds, nutlets, and nutshell fragments. The assemblage included three domesticated cereal taxa: emmer wheat, one-grained einkorn wheat, and hulled barley: one pulse: lentil, flax, two trees: pistachio and grape, and ten wild herbaceous taxa; all of which are associated with the cultivation of cereal and pulse crops. The largest component of the assemblage was wild herbaceous taxa, of which there were 55 specimens and contributed to 40.4% of the total number of items. There were 53 specimens identified as "cereal indeterminate" and comprised 38.9% of the total number of items. The wild herbaceous taxa included *Fumaria* spp., *Brassica alba, Malva spp., Lathyrus / Vicia* sp, *Galium* spp., *Buglossoides tenuiflora*, *Lolium* spp., and 26 specimens that could not be identified higher than family level and subsequently were classified as "Leguminosae indeterminate".

Table 5.4 Densities of the plant remains from Prastion-Mesorotsos including volume of each sample, number of items per sample, number of taxa per sample, number of items per litre, and number of cereals per litre

PM	context	vol. (l)	#items	#taxa	items/l	cereals/l
V	**501**	40	2	2	0.1	0
V	**518**	20	8	5	0.4	0.1
V	**522**	20	5	3	0.3	0.1
V	**510**	20	5	4	0.3	0.15
V	**561**	160	21	6	0.1	0.09
V	**548**	120	22	9	0.2	0.13
V	**551**	50	11	4	0.2	0.18
V	**557**	30	45	9	1.5	0.4
V	**552**	40	5	3	0.1	0.08
V	**559**	90	2	1	0	0.02
V	**543**	55	1	1	0	0
V	**539**	15	2	2	0.1	0
V	**544**	30	0	0	0	0
V	**526**	20	0	0	0	0
V	**554**	90	0	0	0	0
V	**547**	35	0	0	0	0
VI	**549**	50	3	2	0.1	0.04
VI	**538**	35	0	0	0	0
VI	**531**	60	4	3	0.1	0.05

*Table 5.5 List of taxa from Prastion-Mesorotsos samples with plant remains (‘*cf.*’ denotes most similar to; ‘wge’ denotes whole grain equivalent; ‘ub’ denotes ubiquity; ‘gb’ denotes glume bases; ‘w/g’ denotes weight in grams)*

Prastion-*Mesorotsos*	ub.	**Area Unit** total	**V 501**	**V 518**	**V 522**	**V 510**	**V 561**	**V 548**	**V 551**	**V 557**	**V 552**	**V 559**	**V 543**	**V 539**	**V 544**	**V 547**	**VI 549**	**VI 531**
Cereals																		
Triticum dicoccum	4	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Triticum cf. *dicoccum*	8	3	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	2
Triticum monococcum (1)	4	2	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Triticum monococcum (1/2g)	8	4	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-
Triticum cf. *monococcum*	4	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Hordeum sativum	17	5	-	-	2	-	1	-	1	1	-	-	-	-	-	-	-	-
cereal indeterminate	42	53	-	2	-	2	12	12	8	9	3	2	-	-	-	-	2	1
Pulses and flax																		
Lens cf. *culinaris*	12	9	-	3	-	-	2	2	1	-	-	-	-	-	-	-	-	1
Linum cf. *bienne*	4	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Trees and shrubs			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pistacia cf. *atlantica/terebinthus*	4	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vitis sp.	4	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Wild herbaceous taxa																		
Fumaria sp.	4	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
cf. *Brassica* sp.	4	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Brassica cf. *alba*	4	2	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Malva spp.	4	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Lathyrus/Vicia sp.	4	6	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-
Leguminosae indeterminate	25	26	1	1	1	1	-	-	-	21	1	-	-	-	-	-	-	-
Galium sp.	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buglossoides tenuiflora	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Lolium sp.	25	9	-	1	2	-	3	1	-	-	1	-	-	1	-	-	-	-
Gramineae indeterminate	25	7	-	-	-	1	1	1	1	2	-	-	-	1	-	-	-	-
unidentifiable/indeterminate	13	3	-	-	-	1	-	1	-	-	-	-	-	-	-	1	-	-
unidentifiable/indeterminate(w/g)	29	0.1	-	0.014	-	0.006	-	0.007	-	-	-	-	-	0.01	0.026	0.005	0.020	-

5.4 Souskiou-*Laona*

5.4.1 The samples and context types

A total of 2,138 litres from 64 samples were analysed from Souskiou-*Laona* (Operations A, B and D) 39% (25 samples) of which had charred plant remains. There were 137 items and 13 taxa identified and these consisted of charred grains/seeds, chaff, and nutshell fragments. Preservation of the charred plant remains was poor and as a result it was not possible to identify all of the specimens to species. However, most could be assigned to either genus or family.

Context densities of the samples were measured in terms of the number of identifiable remains per litre. These are presented in **Table 5.6** as well as the volume of each sample, the total number of taxa per sample, the total number of items per litre, and the total number of cereals per litre. Overall, the density of remains in the different contexts was low with the maximum number of items per litre 0.33. The context with the greatest number of taxa (seven species/genera) and the largest number of items (64) was Unit 57, which was the richest context and comprised 47% of the total number of items recovered from the site. Unit 57 was described as an ashy pit deposit below an occupation floor in Building 34. Unit 641, another ashy pit fill in Building 34 and below Unit 57, had the greatest density of items per litre. Thus, Building 34 had the greatest number of items per building and the plant remains recovered from it represented 64% of the total number of items (**Figure 5.4**). **Figure 5.5** is a scatter gram plot that shows the relationship between the average number of items per litre and the total volume of the samples for each building. As shown there was no obvious correlation between the density of charred remains and sample size per building. However there was a correlation between the average numbers of items per litre. The total number of samples taken from hearths was 4, general occupation levels was 3, floors was ten, pit fill was 6, and other was 2. **Figure 5.6** reveals that the larger the sample, the greater the density of items. Samples from floors and pits had the largest sample volumes but hearths and pits had the greatest density of charred plant material.

Figure 5.4 Pie chart of the proportional representation (% of total number of remains) per building at Souskiou-Laona

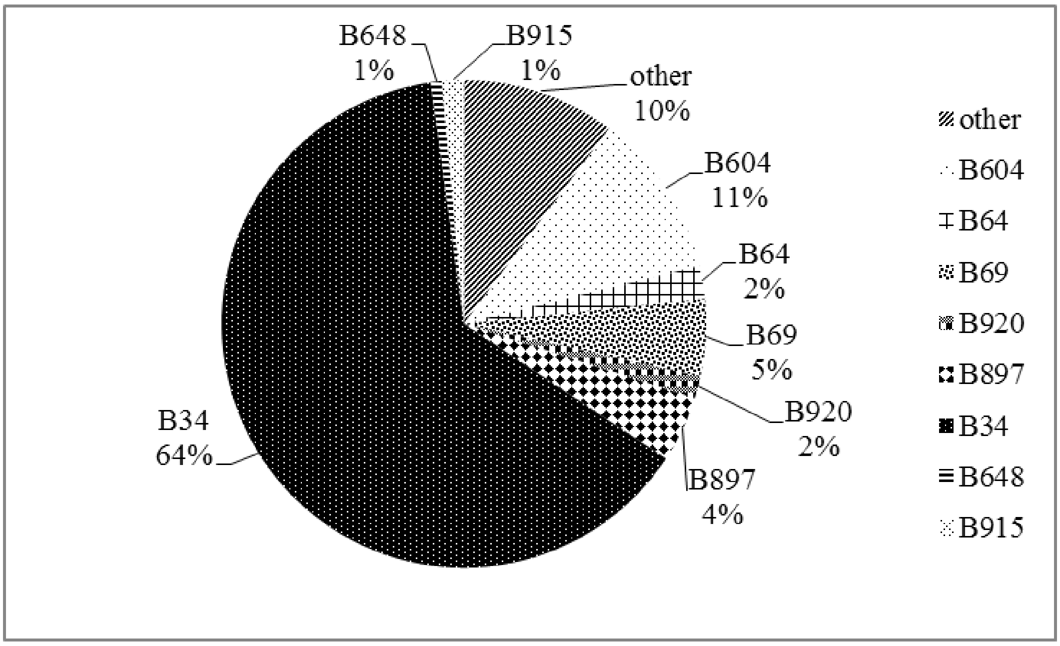


Figure 5.5 Scatter gram plot that shows the relationship between the average number of items per litre for each building and the total volume of the samples, Souskiou-Laona

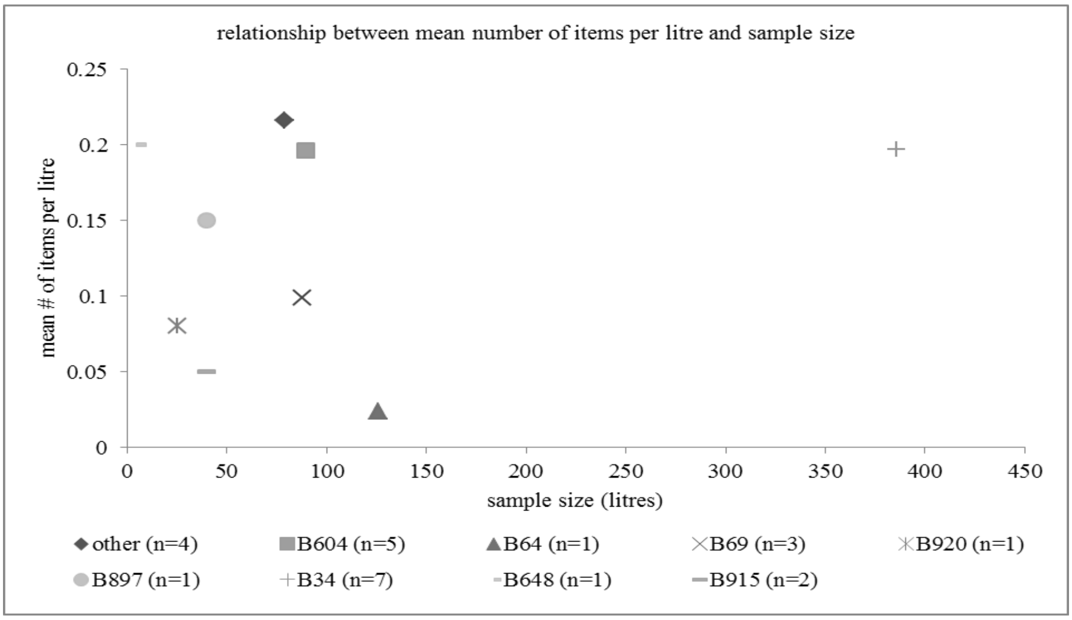
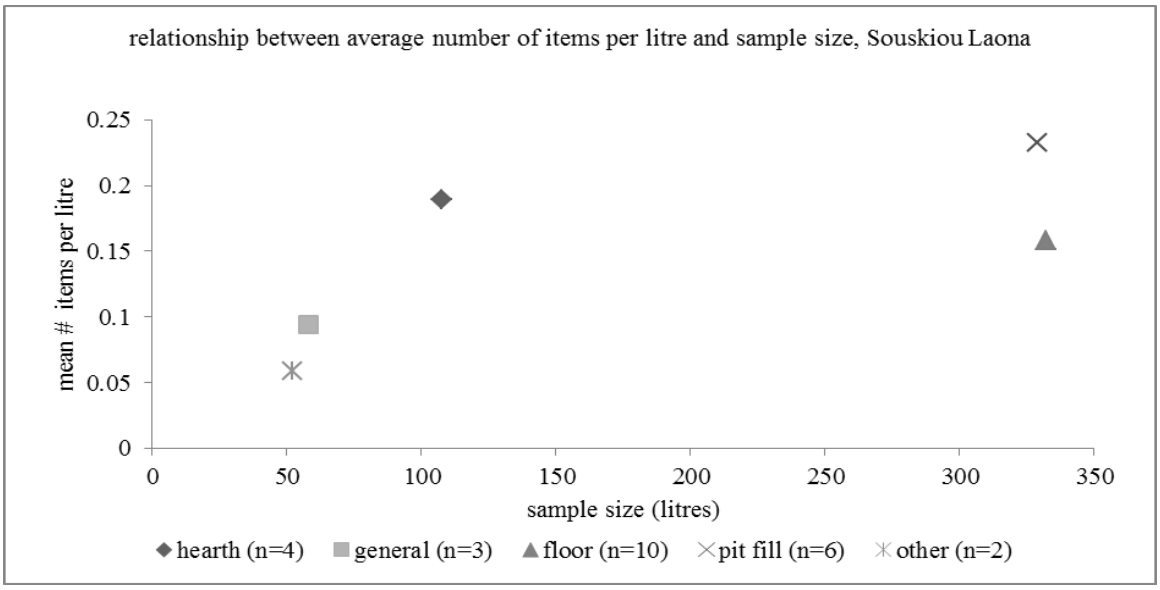


Figure 5.6 Scatter gram plot that shows the relationship between the average number of items per litre for context type and the total volume of the samples, Souskiou-Laona



5.4.2 The plant remains

A total of 13 taxa were identified in the samples, which comprised charred grains/seeds, chaff, and nutshell fragments (**Tables 5.7** and **5.8**). The assemblage included: two domesticated cereal taxa: emmer wheat grains and chaff, and hulled barley; one pulse: lentil; flax; three fruit trees: fig, pistachio and grape; and six wild herbaceous taxa. Cereal grains and chaff are not well represented in the samples, with 12 cereal grains and one glume base. There were two whole barley grains, one of which was asymmetrical. Thus, there is a possibility of grains from both the two-row and the six-rowed variety. The largest components of the assemblage, 65 specimens, were identified as seeds/fruits/nuts of trees, which 66.2% of the total number was fig seeds. The large number of fig seeds is not necessarily representative of its importance at the site because one fig can contain hundreds of seeds and fig seeds are robust, often survive carbonization well, and are able to withstand destruction due to the digestive tracts of animals and therefore are often ubiquitous in archaeobotanical samples. Additionally, charred fig seeds are light and buoyant and therefore have a better chance of rising to the surface during flotation and thus being recovered than heavier specimens. There were a total of 42 items from six wild/weed taxa; however, 17 specimens were identifiable only to family level (i.e. Leguminosae and Gramineae). The remaining wild/weed seeds were identified as *Galium* sp., *Buglossoides tenuiflora*, *Rumex* spp. *and Lolium* spp; all of which are common weed species associated with the cultivation of cereal crops.

Table 5.6 Densities of the plant remains from Souskiou-Laona including volume of each sample, number of items per sample, number of taxa per sample, number of items per litre, and number of cereals per litre

SL Op.	trench	unit	vol.	#items	#taxa	items/l	cereals/l
A	**20**	**1043**	10	0	0	0	0
A	**20**	**1014**	10	0	0	0	0
A	**2**	**741**	20	1	1	0.05	0.05
A	**2**	**709**	20	0	0	0	0
A	**4**	**30**	26	0	0	0	0
A	**4**	**657**	20	0	0	0	0
A	**4**	**779**	20	1	1	0.05	0.05
A	**4**	**31**	10.5	0	0	0	0
A	**6**	**70**	30	0	0	0	0
A	**8**	**64**	55	0	0	0	0
A	**8**	**42**	10	0	0	0	0
A	**8**	**62**	60	0	0	0	0
A	**8**	**76**	25	0	0	0	0
A	**8**	**81**	160	0	0	0	0
A	**8**	**470**	60	0	0	0	0
A	**8**	**485**	40	0	0	0	0
A	**8**	**473**	20	0	0	0	0
A	**8**	**486**	90	0	0	0	0
A	**8**	**515**	10	0	0	0	0
A	**8**	**514**	3	0	0	0	0
A	**8**	**522**	18	0	0	0	0
A	**8**	**533**	8	0	0	0	0
A	**8**	**82**	126	3	2	0.02	0.02
A	**8**	**468**	50	1	1	0.02	0
A	**8**	**528**	11	1	1	0.09	0
A	**8**	**579**	27	5	5	0.19	0.04
A	**8**	**644**	20	0	0	0	0
A	**8**	**665**	22.5	0	0	0	0
A	**8**	**669**	9.5	0	0	0	0
A	**8**	**660**	2.5	1	1	0.4	0.4
A	**8**	**738**	35	10	3	0.29	0.06
A	**8**	**673**	5	0	0	0	0
A	**8**	**810**	10	2	2	0.2	0
A	**8**	**818**	22	1	1	0.05	0
A	**8**	**654**	22	0	0	0	0
A	**12**	**537**	12	0	0	0	0
A	**12**	**561**	15	9	3	0.6	0
A	**12**	**507**	2	0	0	0	0
A	**12**	**453**	15	0	0	0	0
A	**12**	**539**	17	3	2	0.18	0
A	**14**	**524**	27	1	1	0.04	0
A	**14**	**628**	20	0	0	0	0
A	**14**	**622**	15	0	0	0	0
A	**14**	**618**	20	0	0	0	0
A	**20**	**767**	25	2	1	0.08	0
A	**20**	**1038**	270	0	0	0	0
A	**20**	**1102**	40	6	5	0.15	0.05
A	**23**	**793**	20	0	0	0	0
B	**5**	**492**	10	0	0	0	0

SL Op.	trench	unit	vol.	#items	#taxa	items/l	cereals/l
B	**5 to 7**	**67**	5	0	0	0	0
B	**5 to 7**	**72**	25	7	2	0.28	0
B	**5 to 7**	**57**	213	64	7	0.3	0.01
B	**5 to 7**	**494**	25	3	2	0.12	0
B	**5 to 7**	**508**	8	0	0	0	0
B	**5 to 7**	**87**	46	2	2	0.04	0
B	**5 to 7**	**496**	23	0	0	0	0
B	**5 to 7**	**551**	38	5	3	0.13	0.03
B	**5 to 7**	**641**	3	1	1	0.33	0
B	**5 to 7**	**88**	36	6	2	0.17	0
B	**6**	**45**	72	0	0	0	0
B	**6**	**96**	2.5	0	0	0	0
B	**19**	**802**	5	1	1	0.2	0.2
D	**27**	**935**	20	1	1	0.05	0
D	**27**	**913**	20	1	1	0.05	0

Table 5.7 List of taxa from Souskiou-Laona samples with plant remains from Operation A ('cf.*' denotes most similar to; 'wge' denotes whole grain equivalent; 'ub' denotes ubiquity; 'gb' denotes glume bases; 'w/g' denotes weight in grams)*

Souskiou-*Laona*, Operation A	ub.	**tr. unit** total	**2 741**	**4 779**	**8 82**	**8 468**	**8 528**	**8 579**	**8 660**	**8 738**	**8 810**	**8 818**	**12 561**	**12 539**	**14 524**	**20 767**	**20 1102**
Cereals																	
Triticum dicoccum glume bases	2	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Triticum cf. *dicoccum* grains	3	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Hordeum sativum grains	5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
cereal indeterminate (wge)	11	9	-	1	2	-	-	-	1	1	-	-	-	-	-	-	1
Pulses and flax																	
Lens culinaris	17	14	-	-	1	-	1	1	-	-	-	-	1	-	-	-	-
Linum bienne	2	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Trees and shrubs																	
Ficus carica	14	43	-	-	-	-	-	1	-	-	1	1	7	2	1	2	-
Pistacia cf. *atlantica/terebinthus*	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vitis vinifera	8	16	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2
Wild herbaceous taxa																	
Leguminosae indeterminate	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cf. *Galium* sp.	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Buglossoides tenuiflora	3	17	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Lolium sp.	5	7	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-
Gramineae indeterminate	5	16	-	-	-	-	-	-	-	8	-	-	-	1	-	-	-
Rumex spp.	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeterminate whole	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
indeterminate (w/g)	2	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.008

Table 5.8 List of taxa from Souskiou-Laona samples with plant remains from Operation B and D ('cf' denotes most similar to; 'wge' denotes whole grain equivalent; 'ub' denotes ubiquity; 'wig' denotes weight in grams)

Souskiou-*Laona*, Operation B and D	ub.	tr. unit total	B 5 to 7 72	B 5 to 7 57	B 5 to 7 494	B 5 to 7 87	B 5 to 7 551	B 5 to 7 641	B 5 to 7 88	B 19 802	D 27 935	D 27 913
Cereals												
Triticum dicoccum glume bases	2	1	-	-	-	-	-	-	-	-	-	-
Triticum cf. *dicoccum* grains	3	1	-	-	-	-	-	-	-	-	-	-
Hordeum sativum grains	5	2	-	-	-	-	1*	-	-	-	-	-
cereal indeterminate (wge)	11	9	-	2	-	-	-	-	-	1	-	-
Pulses and flax												
Lens culinaris	17	14	1	-	2	1	3	-	1	-	1	1
Linum bienne	2	1	-	-	-	-	-	-	-	-	-	-
Trees and shrubs												
Ficus carica	14	43	-	22	1	-	-	-	5	-	-	-
Pistacia cf. *atlantica/terebinthus*	2	6	6	-	-	-	-	-	-	-	-	-
Vitis vinifera	8	16	-	11	-	1	1	-	-	-	-	-
Wild herbaceous taxa												
Leguminosae indeterminate	2	1	-	-	-	-	-	1	-	-	-	-
cf. *Galium* sp.	2	1	-	-	-	-	-	-	-	-	-	-
Buglossoides tenuiflora	3	17	-	16	-	-	-	-	-	-	-	-
Lolium sp.	5	7	-	5	-	-	-	-	-	-	-	-
Gramineae indeterminate	5	16	-	7	-	-	-	-	-	-	-	-
Rumex spp.	2	1	-	1	-	-	-	-	-	-	-	-
indeterminate whole	2	1	-	-	-	-	-	-	-	-	-	-
indeterminate (w/g)	2	0	-	-	-	-	-	-	-	-	-	-
*= asymmetric barley grains in this sample (n=1)			-	-	-	-	-	-	-	-	-	-

5.5 Kissonerga-*Skalia*

5.5.1 The samples and context types

Ninety-two samples (total volume 2,519 L) were analysed from Kissonerga-*Skalia.* These samples, of which 40% (38 samples) had charred plant remains, were taken from Trenches A, B, C, D, E, H, I, and J. A total of 863 items from 20 different taxa were recovered from the samples. These consisted of charred grains/seeds and nutshell fragments. Preservation of the charred plant remains was poor and as a result it was not possible to identify all of the specimens to species, however most could be identified to either genus or family level.

Table 5.9 lists the volume of each sample (in litres), the number of taxa per sample, the number of items per litre, and the number of cereals per litre. Unfortunately, the contexts were not rich in charred plant remains. However, a relationship between the number of taxa and the volume of the samples is shown and **Figure 5.7** is a scatter gram plot (logarithmic scale) that reveals that there is a positive correlation. Trenches B and G had the largest number of taxa and accordingly they were the trenches with the largest volume processed. A positive correlation between the number of items and the number of taxa is also shown (**Figure 5.8**). Trenches B and G had the largest number of taxa and identifiable specimens. In this plot fig seeds are excluded despite representing 77.3% of the total number of items for the site. This is because fig seeds are often ubiquitous in samples and interpretations of their presence can be misleading. Trench B had the highest average density of items per litre (refer to **Table 5.10**). Trenches B and G include the first MC III-LC1A monumental structures to be identified in the SW of the island (Crewe 2011 pers. comm.). Trench B includes a large curvilinear mud-plastered structure (Feature 33) measuring 2.6m x 1.9m and a large enclosed courtyard. Within this trench there was a furnace-like structure which contained an ashy silt fill (Feature 33) and multiple fire pits, some lined with Red Polished IV pottery, which have been interpreted as cooking/heating areas (Crewe 2011 pers. comm.). The high densities of items recovered from samples from Trench B are likely associated with the furnace feature, which possibly functioned as a tannor (bread oven). **Table 5.11** shows the average number of items per context type for Trench B. This chart highlights that samples from pit fills have the highest number of charred plant remains, but when fig seeds are included, pot fill contents contain considerably more items. However, any interpretation of charred plant material recovered from pot fills must consider the function of the pot. In this case, the fig seeds were recovered from a broken pithos that was re-used as a hearth base, which was recovered from inside the furnace feature. It is possible that the furnace was also used to dry figs and thus the remains of charred fig seeds could be the result of unintentional charring or of discarded figs that were intentionally thrown into the fire. Although figs are often ubiquitous, so any interpretation of them should be made with caution.

Figure 5.7 Scatter gram plot that shows the relationship between the number of taxa and the volume of the samples classified by trench from Kissonerga-Skalia, trend line is logarithmic scale

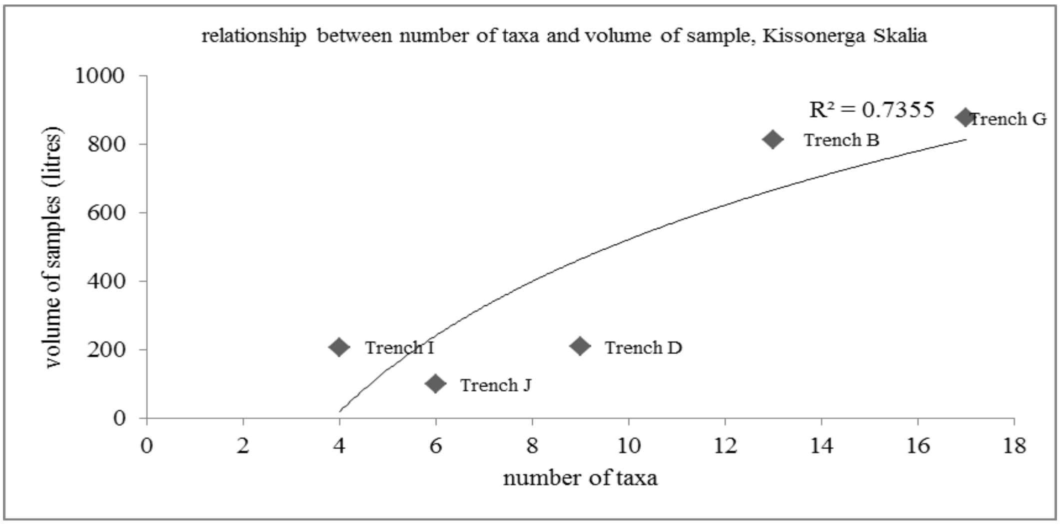


Figure 5.8 Scatter gram plot that shows the relationship between the number of items and the number of taxa classified by trench from Kissonerga-Skalia

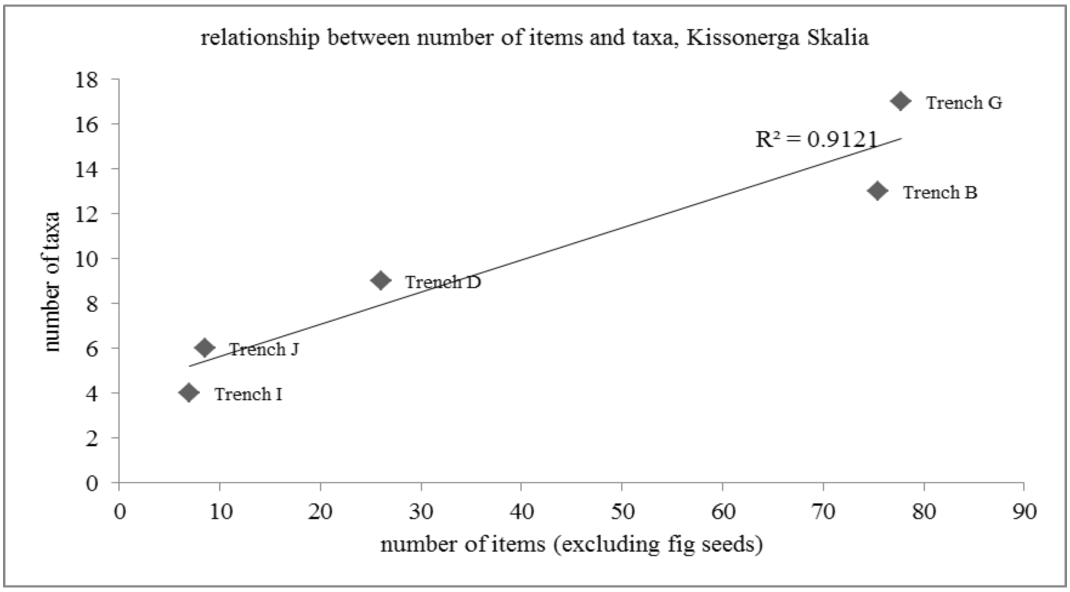


Table 5.10 Table showing the average number of items per litre by trench, Kissonerga-Skalia

Trench	Trench B	Trench D	Trench G	Trench I	Trench J
Number of Samples	14	3	13	4	2
Number of items per litre	1.9	0.175	0.133	0.043	0.085

Table 5.11 Table showing the average number of items per context type, Kissonerga-Skalia

Trench B	pit fill	pot fill	surface	other
Number of items with fig seeds	269	442	2	23
Number of items without fig seeds	81	18	4	23

5.5.2 The plant remains

Hulled barley was the only domesticated cereal in the samples from Kissonerga-*Skalia*. Also identified were two pulse crops, three fruits trees, and 14 wild herbaceous taxa. Taxa from samples from Trenches B, C, and D are listed in **Table 5.12** and taxa from samples from Trenches G, I, and J are **Table 5.13**. Hulled barley was present in 3% of samples and there were a total of four whole grains. *Hordeum sativum* has been used here to refer to cultivated hulled barley since it was not possible to identify any asymmetrical grains in the assemblage. Due to poor preservation and fragmentation there were an additional 21 cereal grains that were classified as 'cereal indeterminate'. The legumes included chickpea and lentil, with a total of three and 13 seeds respectively. The tree and vine crops included fig, pistachio and grape. There were a total of 667 fig seeds and they were present in 15% of the samples. It is difficult to distinguish between the wild and domesticated varieties. However it is likely that the seeds of fig in the samples from Kissonerga-*Skalia* are from the domesticated variety because the tree was large part of food production in surrounding regions at this time (Zohary and Hopf 2000; 2012, 126) and possibly domesticated as early as the Neolithic (Kislev *et al*. 2006). There were a total of 27 nutlets of pistachio and 25 pips of grape. The majority of the grape pips were recovered from one context, Unit 76, Trench B (25 pips). The wild herbaceous taxa were composed of the following species, genera, and families: *Malva* spp., *Ajuga* spp., *Galium* spp., *Carthamus* spp., *Heliotropium* spp., *Amaranthus retroflexus*, *Thymelaea* cf. *passerina*, *Euphorbia* spp., *Euphorbia helioscopia*, *Arrhenatherum elatius*, *Lolium* spp., *Rumex* spp., Leguminosae and Gramineae.

5.5.3 Discussion of results, Kissonerga-*Skalia*

A total of 20 taxa were identified in the samples that comprised charred grains/seeds and nutshell fragments. The assemblage included hulled barley, chickpea, lentil, fig, pistachio, grape, and 14 wild herbaceous taxa, all of which are associated with the cultivation of crops and/or common in fallow fields. The largest component of the assemblage was from trees and shrubs, with an overall total of 719 items. However 92.7% of the total numbers of seeds/fruits/nuts were from fig seeds. The second largest component is from wild herbaceous taxa. There were a total of 102 specimens from 14 wild/weed taxa. This contributed to 11.8% of the total number of identifiable items. Sixteen specimens were identifiable only to the family level only (i.e. Leguminosae and Gramineae). There were a total of 16 pulses in the assemblage, 13 of which were lentils. Cereal grains, exclusively hulled barley, were the least well represented plant in the assemblage. There were only a total of four whole grains, which represent less than 1% of the assemblage. Unfortunately there were very few cereal grains and other charred cereal plant parts identified in the samples and thus precluding the possibility of any discussion of cereal crop processing or agricultural practices. Even though cereal grains were rare in the samples, the 14 wild herbaceous taxa are suggestive of cereal and pulse cultivation. As will be discussed in the interpretations below, some of the wild herbaceous taxa in the Kissonerga-*Skalia* assemblage either appear for the first time in the archaeobotanical record of Cyprus or are introduced to the island in the Late Chalcolithic and Early Bronze Age.

Figure 5.9 Bar chart of the flowering time of the different arable weeds from Kissonerga-Skalia samples. For an explanation of how this was calculated refer to section 5.2.3.

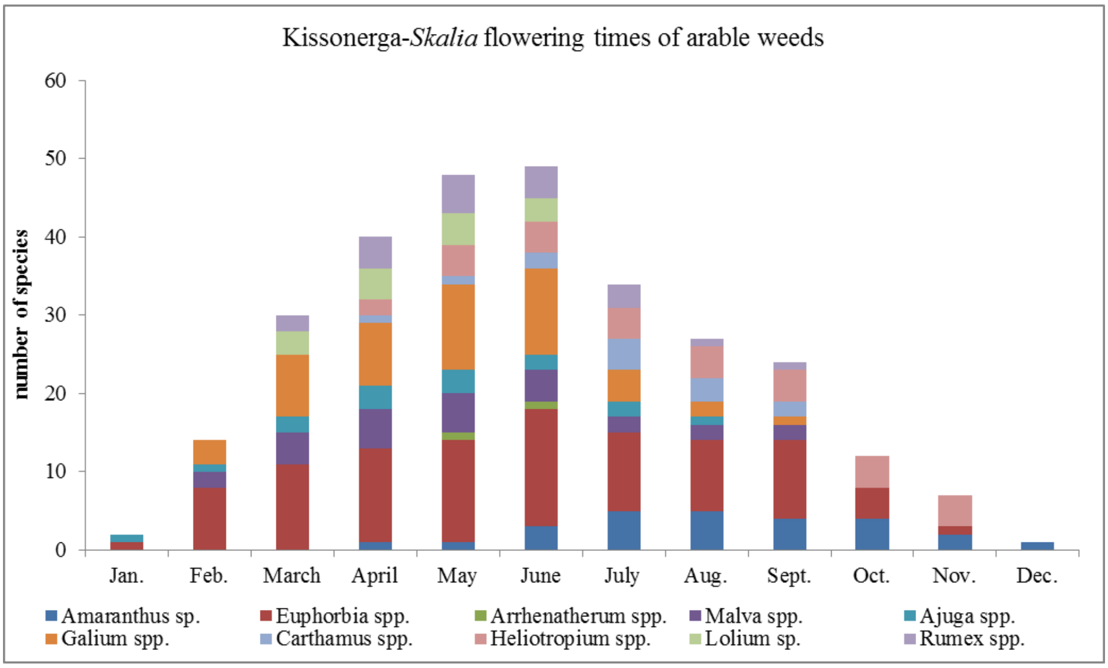


Figure 5.9 is a bar chart of the genera of wild arable weeds in the samples. The flowering times of each of the species from each genus are represented as presented in the *Flora of Cyprus* (Meikle 1977, 1985). The figure shows a slightly different distribution of flowering times than those that were presented for both Krittou Marottou-'*Ais Yiorkis* and Kissonerga-*Mylouthkia*. The distribution of flowering times of the majority of species from the Cypro-PPNB sites discussed above, occur early summer (March to June). The distribution for the species represented in the Kissonerga-*Skalia* samples illustrates a similar pattern but relatively more species appear to flower later in the year, i.e. in late summer (July to August). The differences noted between the Aceramic Neolithic and Bronze Age flowering times highlights the possibility of identifying changes in agricultural practices and seasonality over time. However, the Kissonerga-*Skalia* data is too limited at the moment to address issues of seasonality with certainty. Some of the species in the assemblage flower after the harvest of winter cereal crops. These species could have arrived on the site in ways other than as weeds of cereal cultivation. Evidence of dung has been inferred from samples that are composed of cereal crops (both products and by-products), weed species characteristic of different stages of crop-processing, weeds with low growth heights, the presence of wild taxa that are not associated with the cultivation of cereal crops, and fig seeds (Charles 1998;

Valamoti 2004; 2007). In ethnographic studies it is shown that cereal chaff, mainly glume wheat dehusking waste are often mixed with dung in the production of dung cakes (Charles 1998; Valamoti and Charles 2005). The dung cakes are then burned as fuel and as a result the plant parts (including grains/seeds and chaff) are charred. At Kissonerga-*Skalia* there is little evidence of crop-processing products and no evidence of crop-processing by-products (i.e. other cereal plant parts). However, the by-products of crop-processing are less likely to survive charring and destructive taphonomic conditions than more robust grains and seeds. Interestingly, the large number of fig seeds recovered from inside the furnace feature (Feature 33) could perhaps be the result of burning of dung from animals fed figs (Valamoti 2004; Valamoti and Charles 2005). Although results from analyses of wood charcoal are not included here, the author noted that there was very little wood charcoal in the flotation samples. This also could suggest the burning of dung for fuel. The botanical data recovered from Kissonerga-*Skalia* are perhaps too limited at this time to address the issue of whether or not dung burning for fuel was carried out at the site.

Table 5.9 Densities of the plant remains from Kissonerga-Skalia including volume of each sample, number of items per sample, number of taxa per sample, number of items per litre, and number of cereals per litre

KS trench	unit	vol.	#items	#taxa	items/l	cereals/l
A	**46**	20	0	0	0	0
B	**53**	24	0	0	0	0
B	**76***	26	23	2	0.9	0
B	**59**	35	0	0	0	0
B	**72**	10	0	0	0	0
B	**86**	1	0	0	0	0
B	**34**	120	0	0	0	0
B	**163**	20	4	3	0.2	0
B	**132**	25	0	0	0	0
B	**162**	40	32	3	0.8	0.1
B	**169**	100	17	2	0.2	0
B	**192**	10	14	1	1.4	0
B	**189**	10	16	1	1.6	0
B	**191**	8	0	0	0	0
B	**197**	2	0	0	0	0
B	**188**	15	6	2	0.4	0
B	**193**	10	0	0	0	0
B	**221**	2	0	0	0	0
B	**215**	8	0	0	0	0
B	**223**	2.5	0	0	0	0
B	**231**	0.5	0	0	0	0
B	**232**	0.3	0	0	0	0
B	**212***	26	15.5	7	0.6	0
B	**233***	26	164	4	6.3	0
B	**272**	30	238	3	7.9	0.2
B	**273**	50	179	3	3.6	0
B	**282**	20	25	1	1.3	0
B	**318**	5	0	0	0	0
B	**324**	10	0	0	0	0
B	**328**	1	0	0	0	0
B	**326**	1	0	0	0	0
B	**332**	0.5	0	0	0	0
B	**330**	1.5	0	0	0	0
B	**305**	20	0	0	0	0
B	**336**	8	0	0	0	0
B	**338**	5	1	1	0.2	0
B	**342**	1	1	1	1	0
B	**340**	1.5	0	0	0	0
B	**344**	1	0	0	0	0
B	**308**	10	0	0	0	0
B	**346**	0.3	0	0	0	0
B	**356**	4	0	0	0	0
B	**306**	80	0	0	0	0
B	**310**	8	0	0	0	0
B	**206**	5	0	0	0	0
B	**190**	20	0	0	0	0
B	**317**	1	0	0	0	0
B	**321**	8	0	0	0	0

KS trench	unit	vol.	#items	#taxa	items/l	cereals/l
C	**43**	10	0	0	0	0
C	**60**	10	0	0	0	0
D	**48**	12	0	0	0	0
D	**41**	12	0	0	0	0
D	**161**	5	0	0	0	0
D	**150**	5	0	0	0	0
D	**145**	15	0	0	0	0
D	**158**	15	0	0	0	0
D	**182**	90	0	0	0	0
D	**209**	50	0	0	0	0
D	**183**	50	10	5	0.2	0
D	**218**	20	0	0	0	0
D	**348**	40	11	7	0.3	0
D	**377**	100	5	1	0.1	0
E	**64**	23	0	0	0	0
E	**68**	25	0	0	0	0
G	**52**	13	6	5	0.5	0.2
G	**77**	12	1	1	0.1	0
G	**57**	140	37	14	0.3	0
G	**55**	40	3	3	0.1	0
G	**88**	46	5	4	0.1	0
G	**112**	160	10	5	0.1	0
G	**128**	25	1	1	0	0
G	**134**	30	2	2	0.1	0
G	**187**	10	0	0	0	0
G	**154**	2	0	0	0	0
G	**207**	160	1	1	0	0
G	**210**	5	0	0	0	0
G	**214**	35	8	4	0.2	0
G	**229**	50	6.3	6	0.1	0
G	**237**	2	0	0	0	0
G	**235**	20	2.5	3	0.1	0.1
G	**249***	26	2	2	0.1	0
G	**217**	80	0	0	0	0
G	**369**	20	0	0	0	0
H	**101**	20	0	0	0	0
I	**126**	40	0	0	0	0
I	**131**	55	3	2	0.1	0.1
I	**160**	45	2	2	0	0
I	**159**	20	1	1	0.1	0
I	**168**	45	1	1	0	0
I	**171**	3	0	0	0	0
J	**259**	50	4	3	0.1	0
J	**266**	50	4.5	4	0.1	0

*Table 5.12 List of taxa from Kissonerga-Skalia samples with plant remains from trenches B, C and D (‘*cf.*’ denotes most similar to; ‘wge’ denotes whole grain equivalent; ‘ub’ denotes ubiquity; ‘gb’ denotes glume bases; ‘w/g’ denotes weight in grams)*

Kissonerga-*Skalia*	**ub.**	**Tr. Unit total**	**B 76***	**B 163**	**B 162**	**B 169**	**B 192**	**B 189**	**B 188**	**B 212***	**B 233***	**B 272**	**B 273**	**B 282**	**B 338**	**B 342**	**C 43**	**D 183**	**D 218**	**D 348**	**D 377**
Cereals																					
Hordeum sativum grains	3	4	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
cereal indeterminate (wge)	11	21	-	-	-	-	-	-	-	-	-	5	2	-	-	-	-	-	-	-	-
Pulses and flax																					
Cicer arietinum	1	3	3	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
Lens culinaris	11	13	-	1	-	-	-	-	-	1.5	2	-	-	-	-	-	-	1	-	-	-
Trees and shrubs																					
Ficus carica	15	667	-	2	15	7	14	16	5	8	160	232	176	25	-	-	-	-	-	-	-
Pistacia cf. *atlantica/terebinthus*	22	27	-	-	-	-	-	-	1	1	-	-	1	-	1	1	-	1	-	1	5
Vitis vinifera	4	25	20	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Wild herbaceous taxa																					
Malva spp.	7	10	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	-	5	-
small Leguminosae	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Leguminosae indeterminate	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ajuga chamaepitys	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Galium sp.	3	4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Carthamus sp.	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heliotropium sp.	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Amaranthus retroflexus	5	15	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	6	-	-	-
Thymelaea cf. *passerina*	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Euphorbia helioscopia	4	30	-	-	15	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Euphorbia sp.	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Arrenatherum elatius	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lolium sp.	9	19	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
Gramineae indeterminate	9	10	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Rumex spp.	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
unidentifiable/indeterminate whole	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
unidentifiable/indeterminate w/g	7	1	0.003	-	-	-	-	-	-	-	0.445	-	0.047	-	0.008	-	-	-	-	-	-

Table 5.13 List of taxa from Kissonerga-Skalia samples with plant remains from trenches G, I and J ('cf.'* denotes most similar to; 'wge' denotes whole grain equivalent; 'ub' denotes ubiquity; 'gb' denotes glume bases; 'w/g' denotes weight in grams)*

Kissonerga-*Skalia*	**ub.**	**Tr. Unit total**	**G 52**	**G 77**	**G 57**	**G 55**	**G 88**	**G 112**	**G 128**	**G 134**	**G 207**	**G 214**	**G 229**	**G 235**	**G 249***	**I 131**	**I 160**	**I 159**	**I 168**	**J 259**	**J 266**
Cereals																					
Hordeum sativum grains	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
cereal indeterminate (wge)	11	21	2	-	-	-	1	4	-	-	-	-	1	1	-	2	1	-	-	2	-
Pulses and flax																					
Cicer arietinum	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lens culinaris	11	13	1	-	1.5	-	-	-	-	-	-	2	-	0.5	-	-	-	1	1	-	-
Trees and shrubs																					
Ficus carica	15	667	1	-	4	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Pistacia cf. *atlantica/terebinthus*	22	27	1	-	1.5	1	2	2	1	1	-	1	1	1	1	-	1	-	-	-	-
Vitis vinifera	4	25	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5
Wild herbaceous taxa																					
Malva spp.	7	10	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
small Leguminosae	3	3	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Leguminosae indeterminate	3	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Ajuga chamaepitys	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galium sp.	3	4	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carthamus sp.	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heliotropium sp.	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amaranthus retroflexus	5	15	-	-	2	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-
Thymelaea cf. *passerina*	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Euphorbia helioscopia	4	30	-	-	4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Euphorbia sp.	2	2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Arrenatherum elatius	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lolium sp.	9	19	-	-	12	1	-	-	-	1	-	1	1	-	1	-	-	-	-	-	-
Gramineae indeterminate	9	10	1	1	3	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-
Rumex spp.	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
unidentifiable/indeterminate whole	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
unidentifiable/indeterminate w/g	7	1	-	-	0.007	-	-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	-

5.6 Fruitful contexts in Cypriot Archaeobotany

The poor preservation of charred plant material in Cyprus has been noted previously (Hansen 1991, 2005) and as a result many archaeologists have felt discouraged and consequently excluded archaeobotanical analysis from their research designs. However, the situation is changing and more sites have been added to the island's prehistoric archaeobotanical record. Several sites have made substantial archaeobotanical contributions to prehistoric research on the island, particularly Kissonerga-*Mylouthkia* and Kissonerga-*Mosphilia* (Colledge 2003; Murray 1998, 2003). The quantity and quality of plant remains recovered from these sites enabled the authors to address issues regarding the spread of agriculture to the island and the economy of Chalcolithic Cyprus, more generally. One must then question the causes for the differences between data recovered from botanically rich sites and those sites which contain very few poorly preserved specimens. It is argued here that in addition to differences in recovery (i.e. sieve size) and identification (naked eye versus microscope sorting) methods (discussed in Chapter 4), differences/inadequacies in sample size, context type, and population density are possible factors that have adversely affected the Cypriot archaeobotanical record.

As is the case with all archaeological data, preserved botanical material is subject to biases in deposition, preservation, and recovery. As stated by Fuller and Weber (2005, 103) only a small portion of the seeds from a site became charred, a smaller number are preserved, a smaller number survive fragmentation, and an even smaller number are retrieved in excavation and processed in flotation. Despite this, there is a remarkable amount of charred remains recovered from archaeological contexts. Generally plant remains recovered are the result of either accidental or intentional burning and are indicative of their own "immediate circumstances" (van der Veen 2007, 979; Renfrew 1973, 21). It is unsurprising that there is considerable variation reported in the quantities and densities of botanical data across contexts, sites, and regions. It could be said that there are nearly the same number of depositional conditions and circumstances of preservation as there are contexts and samples. Differences in quality (e.g., how well or otherwise specimens are preserved) and quantity between botanical assemblages from sites located in Cyprus have been shown above and also in Chapter 4. This section discusses possible explanations for differences between charred botanical data from sites located in Cyprus and these are compared to sites located in the mainland Levant.

Figure 5.10 is a scatter gram plot that shows the relationship (i.e. positive correlation) between the number of taxa and the volume of samples from sites located in Cyprus and the mainland Levant. The figure reveals the relationship (i.e. positive correlation) between the number of taxa and the total volume of samples for each site. The exceptions to this were sites with smaller sample sizes but with comparatively large numbers of taxa. These sites included Jerf el Ahmar and Tell Qaramel (Willcox 2002, 2012), discussed below. **Figure 5.11** is a scatter gram plot that indicates a positive correlation between the number of items and the number of taxa. The plot reveals that the number of items is proportional to the number of taxa, thus the more specimens recovered, the more taxa identified. However the likelihood of identifying new species is reduced as more species are recognized because there is a limit to the number of taxa in the botanical record. A consideration of context types is necessary as well. The sites that had relatively smaller volume sizes but larger numbers of identified items, identifiable items per litre, and a greater number of taxa, such as Jerf el Ahmar, Tell Qaramel, Dja'de, Tell'Abr (Willcox 2002, 2012), Wadi el-Jilat 13, and Iraq ed-Dubb (Colledge 2001) have greater densities of plant material because they come from context types that have better preservation conditions (**Table 5.14** for site densities). As presented above, there are various context types that are all subject to different deposition and preservation biases, some of which may provide protection against adverse taphonomic conditions. Contexts that tend to protect charred macro remains from destruction are usually located away from common habitation areas (Colledge 2001), such as pits, both rubbish and storage, and storage containers in general. Thus, the sites that were rich in botanical material are sites that have samples primarily from burnt storage structures (e.g. Tell'Abr), storage contexts, and pits, both rubbish and storage containers used secondarily for rubbish (e.g. Dja'de, Kissonerga-*Mylouthkia*, Kissonerga-*Mosphilia*). In opposition, the sites where samples have been taken from primarily habitation areas (e.g. structure floors and general fill) have comparatively lower seed densities. The lower densities in these contexts could be a result of the inhabitants keeping the areas swept and tidy. Also, preservation of the charred remains would have been compromised due to fragmentation caused by constant trampling. Further, the sites that have richer seed densities tend to be mound sites that have contexts buried and protected by subsequent deposition. While, samples from tomb contexts, although protected from destructive processes, are less likely to have large amounts of charred macro remains because they are removed from domestic activities such as crop-processing and cooking, and other activities which may involve recurrent charring incidents.

Figure 5.10 Scatter gram plot that shows the correlation between the number of taxa and the volume of samples (in litres) from sites located in Cyprus and the mainland Levant[7]

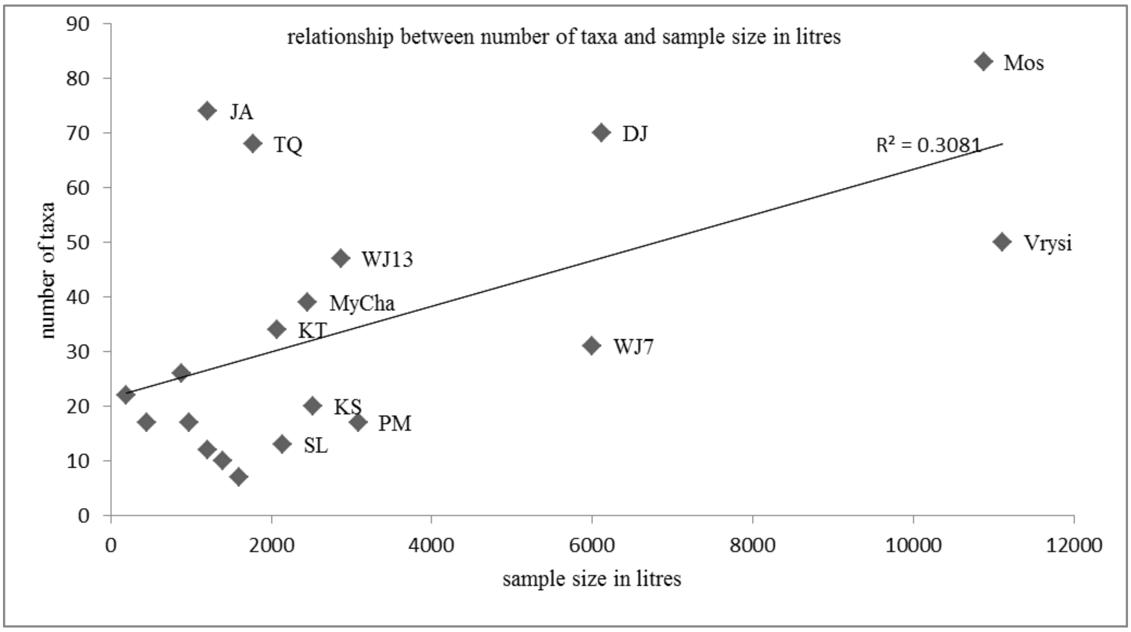
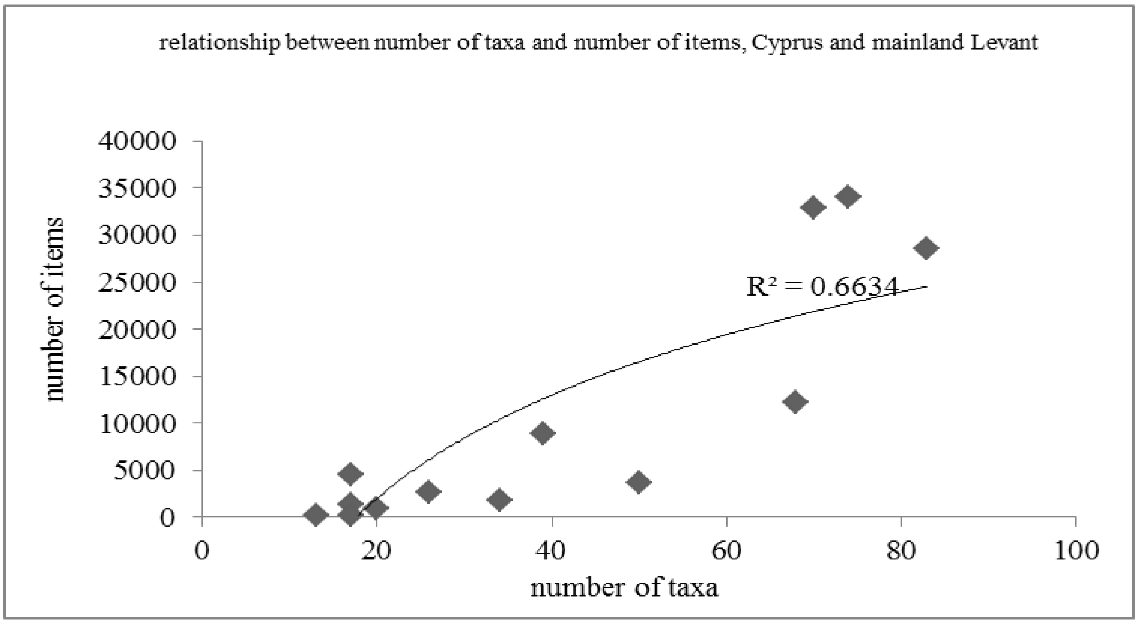


Figure 5.11 Scatter gram plot that shows the correlation between the number of taxa and the number of items from sites located in Cyprus and the mainland Levant



[7] [7]: *JA (Jerf el Ahmar); TQ (Tell Qaramel); DJ (Dja'e); Mos (Mosphilia); Vrysi (Ayios Epiktitos-Vysri); WJ7 (Wadi el-Jilat 7); WJ13 (Wadi el-Jilat 13; MyCH (Kissonerga-Mylouthkia Chalcolithic), KT(Kalavasos-Tenta); KS (Kissonerga-Skalia); PM (Prastion-Mesorotsos); SL (Souskiou-Laona)*

In consideration of both context type and type of site deposition, it is not surprising that the Cypriot dataset appears meager as there is no evidence for accumulated settlement mounds (i.e. tell sites) on the island and there is limited evidence of large-scale storage before the Late Chalcolithic (Peltenburg 1993). In addition, the population density of Cyprus in prehistory has always been argued to be quite low (Croft 1991; Clarke *et al*. 2007). Evidence for low population density has been inferred from site size, site distribution, and faunal data, particularly the correlation between societies with low populations and a reliance on hunting (Croft 1991). The discussion presented here is not intended to paint a bleak picture for the prospects of recovery on archaeological excavations in Cyprus. Rather, it seeks to highlight the importance and value of obtaining large sample sizes and to illustrate the potential for effective sampling strategies.

5.7 Conclusions

This chapter presented the results of the analyses of the botanical material recovered from Krittou Marottou-'*Ais Yiorkis*, Prastion-*Mesorotsos*, Souskiou-*Laona,* and Kissonerga-*Skalia*. For each site the plant species present in samples were described and when possible comparisons between samples and/or context types were discussed. As a result of the limitations to the data recovered from these sites it was decided to address issues regarding agricultural practices on an island-based level. Also, the data presented in this chapter have been added to the Cypriot dataset and will be included in the multivariate comparative analysis of data from the island and the mainland Levant, the results of which will be presented in the following chapter.

Table 5.14 Table of the average number of identifiable items per litre for sites located in Cyprus and the mainland Levant

Site	Total Number of Samples	Average Number of Items Per Liter
***Mylouthkia* Aceramic Neolithic**	12	2.7
***Mylouthkia* Chalcolithic**	5	3.445
'*Ais Yiorkis*	42	0.346
Kalavasos-*Tenta*	175	0.899
Prastion-*Mesorotsos*	19	0.178
Ayios Epiktitos-*Vrysi*	33	0.328
Kissonerga-*Mosphilia*	306	2.622
Souskiou-*Laona*	25	0.162
Kissonerga-*Skalia*	14	0.803
Wadi al-Hammeh 27	12	2.32
Iraq ed-Dubb	32	31.03
Wadi el Jilat 6	42	1.45
Wadi el-Jilat 7	68	2.84
Wadi el-Jilat 13	87	43.37
Azraq 31	61	0.29
Tell Qaramel	108	6.991
Jerf el Ahmar	227	28.131
Tell'Abr	30	10.017
Dja'de	229	5.384

Chapter 6

Comparative Archaeobotanical Results

6.1 Introduction

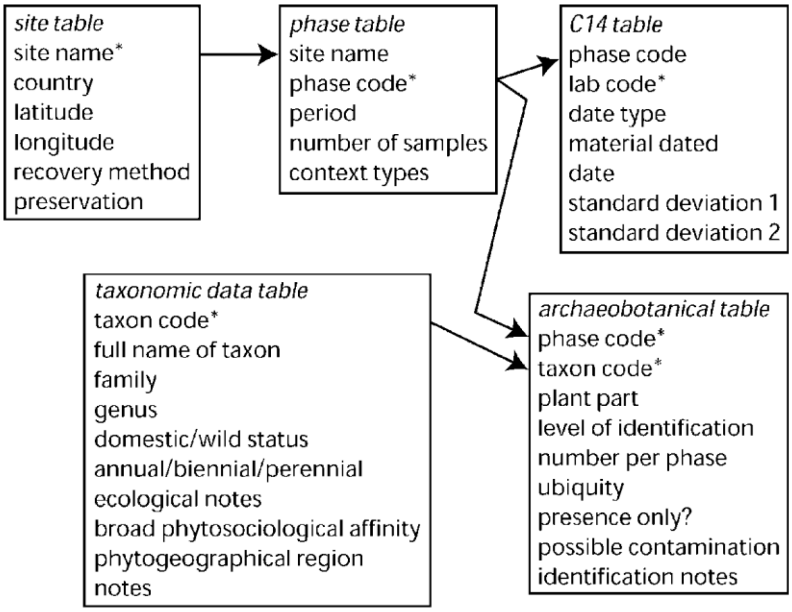
Having presented the results of the analyses of the botanical remains from four diachronic sites on Cyprus, the results from a comparative analysis of the botanical assemblages from Cypriot prehistoric sites and contemporary sites located in the mainland Levant will be presented. Archaeobotanical data from Turkey, Syria, Jordan, Egypt, Israel and Palestine, dated to the Aceramic Neolithic (hereafter AN), Ceramic Neolithic (hereafter CN), Chalcolithic (hereafter CHAL), and early and middle Bronze Age (hereafter BA) are included in this discussion. The objective of this analysis is to define any patterns in the data that might illustrate regional and chronological similarities and/or differences between sites located in Cyprus and the surrounding regions over time. Correspondence Analysis (hereafter CA) was used to explore the relationships between the Cypriot and mainland botanical data. CANACO (Ter Braak 1988) was the software program used for analyses and CANODRAW (Smilauer 1992) was the software program used to illustrate the results of CA in graphical form.

The datasets used in the analyses will be discussed, including details of the modifications made to the data, e.g. exclusions from the analyses. The first section of this chapter presents the results of the comparative analysis between Cyprus and the mainland Levant, Turkey, and Egypt. The objective is to explore the evidence for change in island contacts over time. The results of a comparative analysis of data from sites located in Cyprus are presented in the second section, which explores the relationship between samples from sites dated to the AN, CN, CHAL, and BA (early, middle, and late). The objective of this section of the analysis was to define any patterns in the data that might show chronological change in the island's economy over time and more specifically to highlight differences in the taxonomic compositions that could suggest changes in crop choice and agricultural practices, including intensification and diversification.

6.2 Refining the dataset

The data used in this analysis comprise an amalgamation of three relational databases; the author's Cypriot database, the Near Eastern database by Shennan and Conolly (2007), and The Archaeobotanical Database at the Insitute of Pre- and Protohistory and Medieval Archaeology at the University of Tübingen (Riehl and Kümmel 2005). The design of all three relational databases followed the template outlined in Colledge *et al.* (2004**) (Figure 6.1).** There were slight differences between individual recording styles and as a result it was important; first to refine the data that would be imported into the program CANACO for CA.

Figure 6.1 The data model taken from Colledge et al. (2004 p. S37) ("" denotes primary field; arrows show one-to-to many relationships)*



All taxa identified to family level (e.g. Leguminosae, Compositae, etc.) were excluded. Included in the analysis were specimens identified to species and genus level only (following Colledge *et al.* 2004). Since the Cypriot dataset did not include wood charcoal data it was decided to exclude wood charcoal from the dataset for consistency. Given that the aims of the analyses were to explore similarities/differences in taxonomic composition and not individual plant parts, all categories (e.g., of grains, chaff, etc.) were combined to prevent duplication of species, and genera. Einkorn wheat and emmer wheat grains and chaff were combined to all represent glume wheat. Similarly, all specimens identified as 2-row, 6-row, or indeterminate hulled barley were pooled to represent one category of hulled barley as distinct from naked barley. This was done because of the identification problems associated with hulled barley; specifically, there have been differences and inconsistencies in the identifications of the 2-row and 6-row varieties. Specimens identified as indeterminate between free-threshing wheat and glume wheat, hulled and naked barley, and rye and wheat were excluded from the analysis. The Cypriot and mainland analyses includes presence and absence data only, as a number of the authors did not report absolute quantities and at the regional level presence and absence data helps to eliminate differences between sites, contexts, and preservation of plant material. For the exploration of the wild/weed taxa, only potential weeds associated with the cultivation of crops (i.e. arable weeds) were included. This was to explore changes in agricultural practices over time. Taxa that were excluded from the analysis of the wild taxa included wild species of trees, vines, and shrubs (e.g. *Olea* sp., *Vitis* sp., *Pistacia* spp., *Ficus* sp.).

The sites were categorised according to the following geographical regions: Cyprus, Jordan, Syria (Euphrates Valley and central steppe), Syria (northwest, Damascus basin, and the Mediterranean coast), Turkey (central Anatolia), Turkey (southeast), Israel and Palestine Authority, and Egypt. However, for easier reading the regions will be referred to as follows: Cyprus, Jordan, Euphrates Valley (for samples from the Syrian Euphrates Valley and central steppe), western Syria (for samples in northwest Syria, Damascus basin, and the Mediterranean coast), central Anatolia (for Turkish central Anatolian sites), SE Turkey (for samples from southeast Turkey), Israel and Palestine, and Egypt (**Figure 6.2**). Refer to **Appendices 3 and 4** for a complete list of the sites, phase codes, taxa, and taxon codes used in this analysis. **Table 6.1** is a summary of the ubiquities of cereal crops for each region and each cultural period and is the data used in the univariate analysis presented in this chapter.

Figure 6.2Map showing the geographical regions compared in Correspondence Analysis (Google Earth 2012)

Table 6.1 Ubiquities of the cereal crops that will be used in bar charts presented in this chapter ("N" denotes number of samples/phases; "– " denotes no data/evidence; '' denotes tentative evidence)*

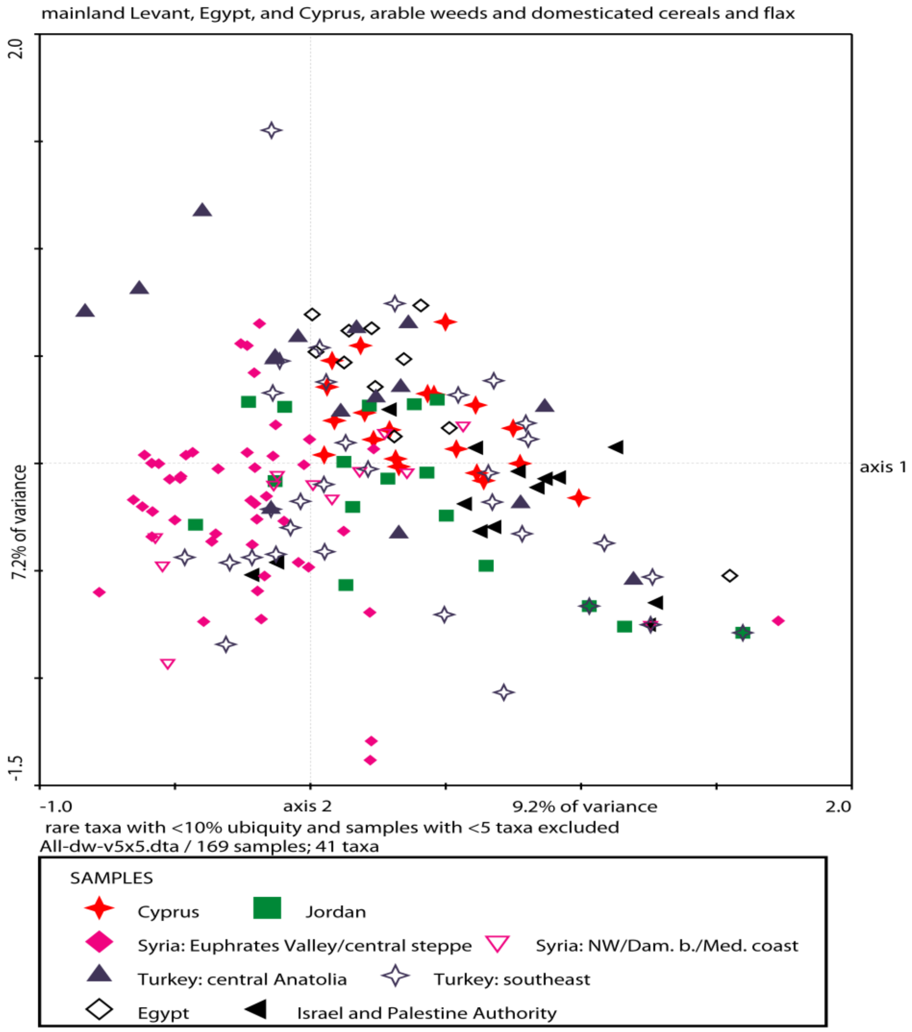
Regions	Periods	N	Glume wheat	Free threshing wheat	Hulled barley	Naked barley
Cyprus	Neolithic	9	56	-*	56	-*
	Chalcolithic	8	63	63	100	0
	Bronze Age	4	75	-	25	-
Jordan	Neolithic	9	67	33	67	22
	Chalcolithic	6	33	83	83	0
	Bronze Age	6	67	33	50	-
Syria: Euphrates valley, central steppe	Neolithic	8	75	88	75	75
	Chalcolithic	9	44	56	78	0
	Bronze Age	32	78	75	81	-
Syria: NW, Med. coast Damascus basin	Neolithic	7	100	71	100	57
	Chalcolithic	1	100	100	100	0
	Bronze Age	6	83	75	100	-
Turkey: central Anatolia	Neolithic	7	57	29	43	13
	Chalcolithic	5	60	37	40	20
	Bronze Age	6	67	67	67	6
Turkey: southeast	Neolithic	8	100	38	25	13
	Chalcolithic	12	58	50	58	8
	Bronze Age	17	71	71	65	6
Israel and Palestine Authority	Neolithic	-	-	-	-	-
	Chalcolithic	11	0	9	36	0
	Bronze Age	24	29	29	38	4
Egypt	Neolithic	-	-	-	-	-
	Chalcolithic	8	25	25	63	13
	Bronze Age	6	83	-	67	-

6.3 Comparative analysis

6.3.1 Exploration of the dataset

This section presents the results of a comparative analysis of data from sites located in Cyprus, Syria, Turkey, Egypt, Israel, and Palestine and dated to the AN, CN, CHAL, and early and middle BA. The samples in the CA plots in this section were classified according to region with each country represented by a different color and each region represented by a different symbol. **Figure 6.3** is an exploratory samples plot of all samples and includes domesticated cereals and arable weed taxa. Taxa excluded from this plot include both wild and domesticated trees, vines, and legumes. Rare taxa that were present in less than 10% of the samples were excluded, as were samples (e.g. phases of sites) that contained less than five species/genera (i.e. taxon codes). These cut-off points (of rare taxa and small samples) have been successful in revealing patterns in the relationships between samples and taxa in similar CA archaeobotanical assemblages (Colledge et al 2004). The inclusion of both rare taxa and sites with small samples likely create noise and obscure patterns in the dataset (Lange 1990, 75-76, see also Jones 1991, 68-69, Colledge 2001, 183-191, Colledge *et al.* 2004). The total number of samples included in this plot was 169 and the total number of taxa (i.e. species/genera) was 41. The first axis accounts for 9.2% of the variation and it is along this axis that a majority of the samples from Syria are separated from the other sites. The majority of the Syrian samples have negative values on axis 1 and the majority of samples from Cyprus, Jordan, Turkey and Egypt have positive values. This exploratory plot illustrates the potential for regional patterning in the dataset. Further, it demonstrates that there are patterns in the data that are regionally as opposed to chronologically based. It highlights possible continuity in the taxonomic compositions of each region over time.

Figure 6.3 CA samples plot of arable weed taxa and domesticated cereals and flax from sites located in the Levant, Egypt, and Cyprus and dated to the AN, CN, CHAL, early and middle BA



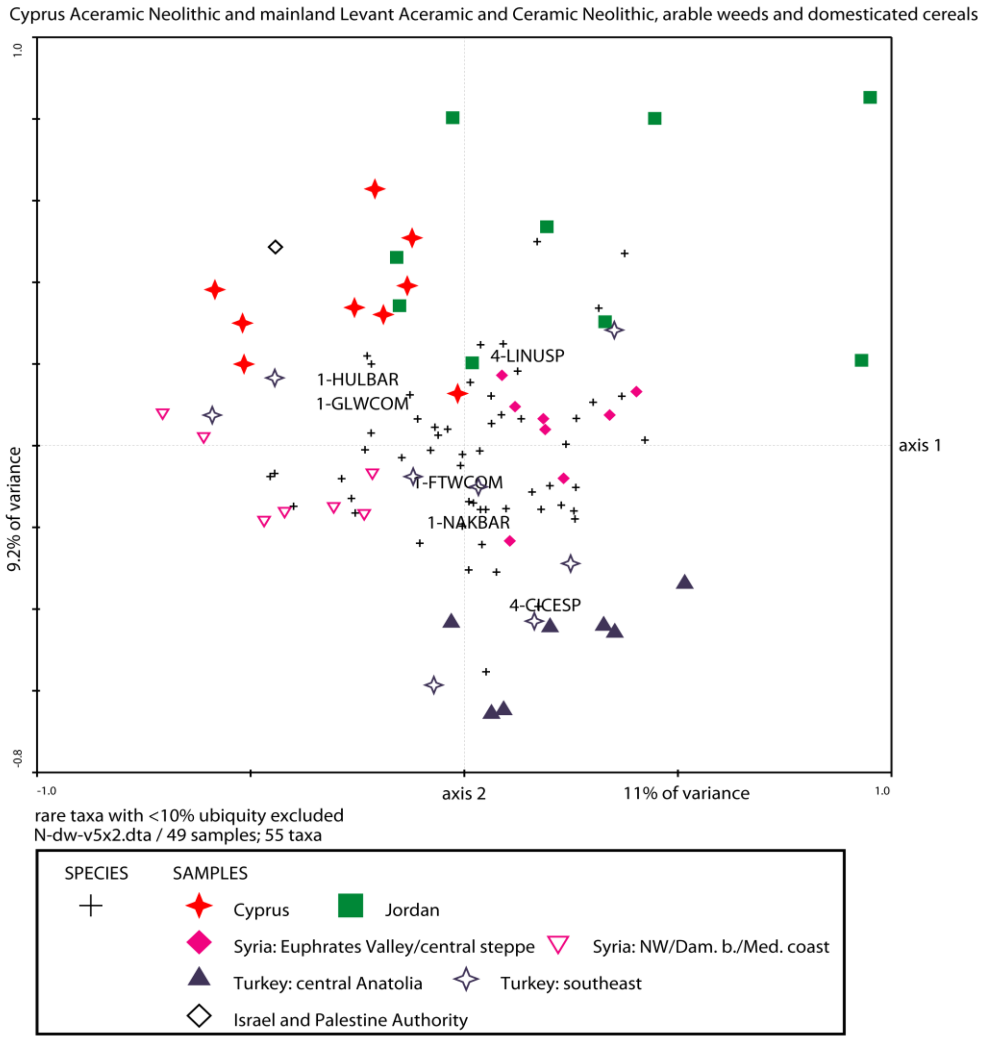
6.3.2 Explanation of Chronological Groupings

Patterns in the data are more clearly illustrated if the data are separated into smaller chronological groups. In the following sections the results of first, the Neolithic data, and second, both the Chalcolithic and early and middle Bronze Age data are presented. The dataset was divided into two groups based on chronology and similarities between cultural entities. The Neolithic group included the Cypro-PPNB and Khirokitian periods and the PPNB and Pottery Neolithic periods of the mainland Levant, with a date range between *c*. 9500 cal. BC and *c*. 4500 cal. BC. The Ceramic Neolithic of Cyprus was included in the CHAL and BA group. In addition to the Ceramic Neolithic of Cyprus (i.e. Ayios Epiktitos-*Vrysi* and limited data from Kantou), the CHAL and BA group included the CHAL and early and Middle BA of Cyprus, the mainland Levant, Turkey and Egypt, with a date range from *c*. 4500 cal. BC to *c*. 1500 cal. BC. This was due to the limited data available from the Cypriot Ceramic Neolithic and early and middle Bronze Age. However, analyses of the Chalcolithic and Bronze Age data are presented briefly to further support the patterns revealed in the CA.

6.3.4 Comparative Neolithic

This section presents the results of a comparative analysis of the data from the Aceramic Neolithic of Cyprus and the Aceramic and Ceramic Neolithic of the mainland Levant and Turkey. All samples in the following plots were classified according to country and region, with each country represented by a different color and each region a different symbol. **Figure 6.4** is a bi-plot of the arable weed taxa and domesticated cereals and flax. This plot shows the relationship between 49 samples and 55 species/genera after rare taxa that were present in less than 10% of the samples were excluded. The first axis accounts for 11% of the variation and the second axis represents 9.2% of the variation. This figure shows that the taxonomic compositions of the Neolithic samples were regionally distinct. There is a clear separation between the Cypriot and western Syrian samples and the central Anatolian, Euphrates Valley, and Jordanian samples. The Cypriot samples have negative values along the first axis with the samples from sites located in the western Syria. Also, hulled barley (1-HULBAR) and glume wheat (1-GLWCOM) have negative values along axis 1 and are located in the top left quadrant. Further, along the second axis there is a clear separation between samples located in Cyprus and those located in western Syria. The Cypriot sites have positive values on axis 2 and the Syrian sites have negative values on this axis. There also is a clear difference between the Jordanian, central Anatolian, and Syrian Euphrates samples, all of which have positive values on axis 1. It is along the second axis that a separation between samples from these regions is highlighted: the samples from sites located in central Anatolia cluster in the bottom right quadrant, the Jordanian samples primarily in the upper right quadrant, and the Euphrates Valley samples are pivotal between the two.

Figure 6.4 CA bi-plot of arable weed taxa and domesticated cereals and flax from sites located in the Cyprus and dated to the AN and the mainland Levant and Turkey and dated to the AN and CN



In CANODRAW samples can be displayed as pie charts that illustrate the proportion or comparative quantities of taxa or groups of taxa present in each sample. **Figure 6.5** is an equivalent pie chart plot for the results of CA portrayed in **Figure 6.4**. In this figure domesticated wheat, barley, and flax are represented by different color slices, which denote the relative proportions of those taxa for each sample. This figure illustrates more clearly the relationships between the taxa and samples and facilitates interpretation of the patterns according to taxonomic composition. There is a clear separation between samples with a greater proportion of glume wheat and hulled barley and those with a greater representation of free-threshing wheat and naked barley. The samples with a greater representation of glume wheat and hulled barley are from Cyprus and western Syria and the samples with a greater representation of free-threshing wheat and naked barley are from Jordan, the Euphrates Valley and Turkey (both southeast and a majority of the central Anatolian samples). The difference between the western Syrian samples and the Cypriot samples is based on the absence of free-threshing wheat in Cyprus and the presence of free-threshing wheat and domesticated flax in Syria. The separation between the samples from Turkey is based on the presence of wild chickpea (refer to bi-plot, **Figure 6.3**). This is not unexpected considering the distribution of the wild progenitor species, which is located in southeast Turkey (Zohary and Hopf 2002; Weiss and Zohary 2011).

Figure 6.5 CA pie chart plot of arable weed taxa and domesticated cereals and flax from sites located in the Cyprus and dated to the AN and from sites located in the mainland Levant and Turkey and dated to the AN and CN

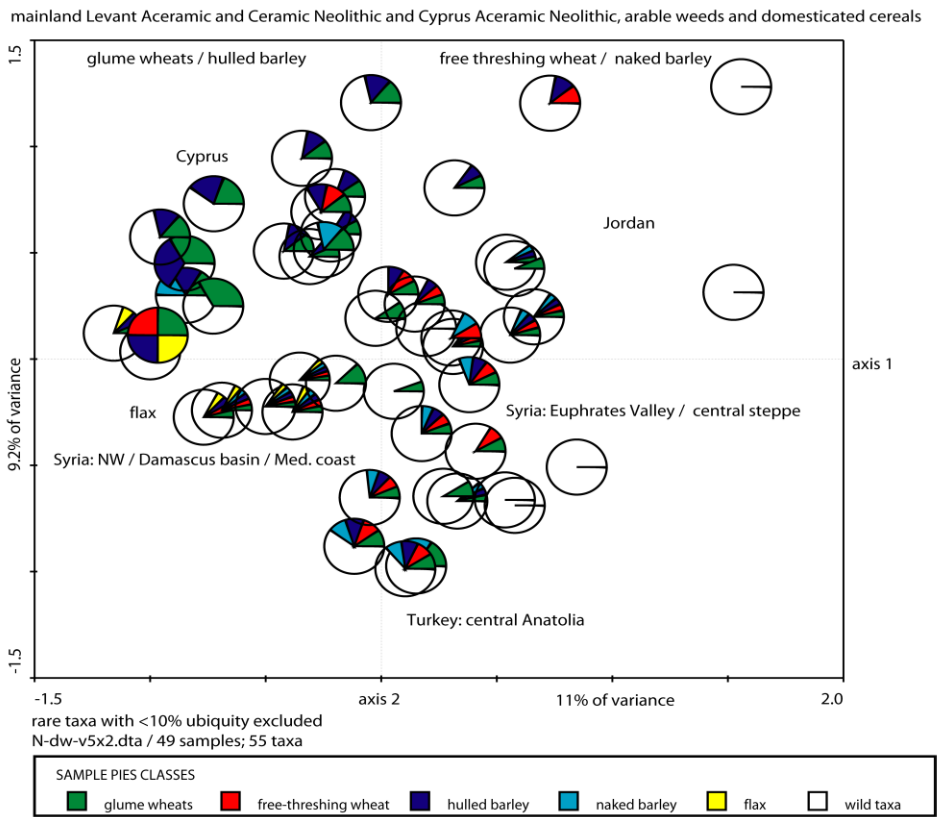
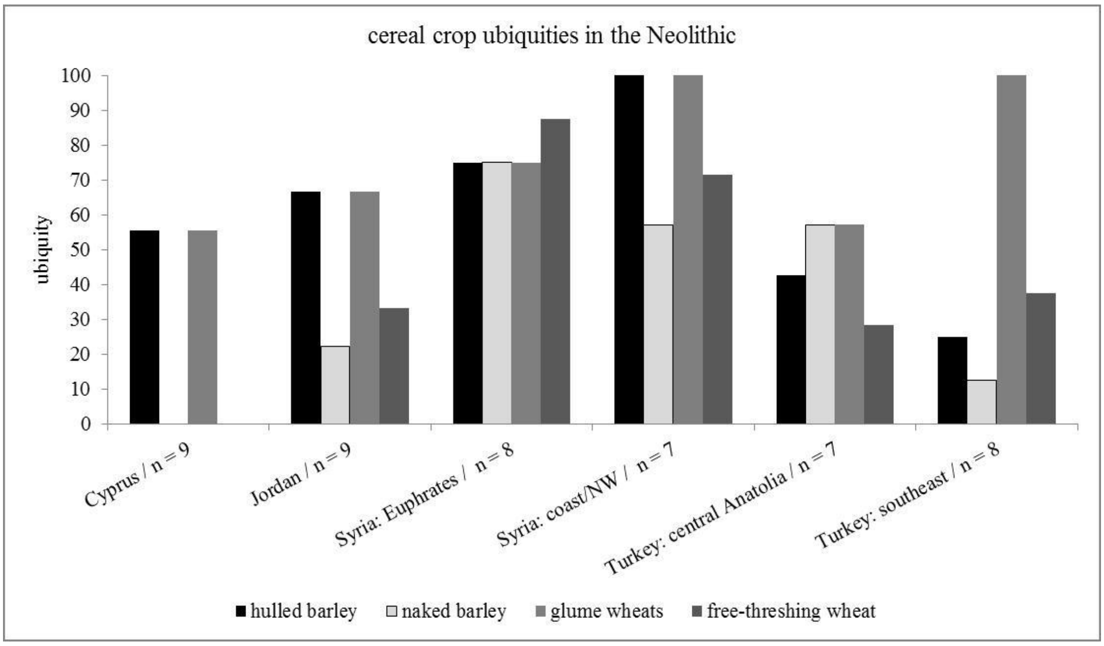


Figure 6.6 is a bar chart that shows the ubiquity of the four cereal crops in the Neolithic. This is calculated based on the percentage of sites for each region that have evidence for each cereal crop. As shown, Cyprus is regionally distinct based on the absence of both free-threshing wheat and naked barley in the Aceramic Neolithic. All of the other regions have evidence of both glume and free-threshing wheat and both hulled and naked barley. There are regional differences in the ubiquities of cereals for each region as well. For instance, Jordan has greater ubiquities of both hulled barley and

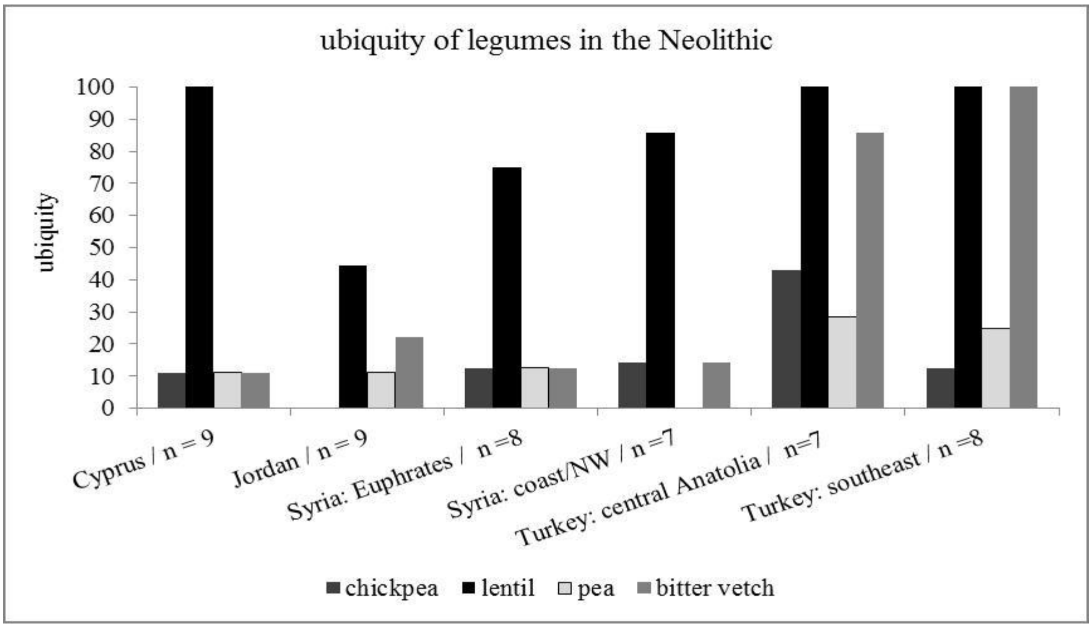
glume wheat, southeast Turkey has a higher ubiquity of glume wheat, and Syria (both regions) has more or less equal percentages of all four cereals represented.

Figure 6.6 Bar chart of cereal crop ubiquities from sites located in Cyprus, Jordan, Syria, and Turkey and dated to the Neolithic period; "n" denotes number of samples



There are also regional differences in the compositions of domesticated legumes. **Figure 6.7** is a bar chart that shows the ubiquities of domesticated legumes. Lentil is ubiquitous in all regions, although it is far less common in Jordan than the other regions. Of note are the differences in the compositions of legumes for each region, which includes a greater number of sites located in central Anatolia with chickpea as well as a greater number of sites located in Turkey (both regions) with bitter vetch and pea. With the exception of lentil, Cyprus, Jordan, and Syria (both regions) have low ubiquities of chickpea, pea, and bitter vetch. Thus, the compositions of ubiquities of the domesticated cereals and legumes in Neolithic support the regional differences highlighted in the CA.

Figure 6.7 Bar chart of legume ubiquities in from Neolithic sites located in Cyprus, Jordan, Syria, and Turkey; "n" denotes number of samples



The presence of weeds in archaeobotanical studies can be used as indicators of soil fertility. In phytosociological studies (i.e. the study of the relationship between plant communities and their environments) of weeds there are two plant groups phytosociological syntaxa) that have been used as indicators of soil fertility, Chenopodietea (summer crop and ruderal weeds) and Secaliatea (winter crop weeds) (Küster 1991, 20; Wilkinson and Stevens 2003, 182-190; Jones 1999, 167; see also Zohary 1950, 387-410 for Secaliatea). Chenopodietea are typically associated with crops grown in gardens and the presence of these weeds has been used as an indicator of well-manured gardens. In opposition, the presence of species of Secaliatea (typically grasses and perennials) has been used to infer winter-sown crops grown on less fertile soils, with little manure, and little or no irrigation (Jones 1999, 167; Bogaard *et al.* 2005, 505-506; Zohary 1950, 408; see also Nesbitt 2006, 9). Generally, species of the Chenopodietea and other annuals are more nitrophilous and favored by manuring and thus, have been used as a signature of intensive garden cultivation. This is in opposition to what has been inferred for the grasses and other perennial weeds, which are associated with nitrogen deficiency and little field maintenance, i.e. no soil disturbance or crop rotation (Warington 1924, 115, see also Jones 1992, 140; van der Veen 1992, 107). In this analysis, five plant families will be discussed in terms of general soil types, Chenopodiaceae, Polygonaceae, Leguminosae, Gramineae, and Cyperaceae. The plant families Chenopodiaceae and Polygonaceae are within the group Chenopodietea and will be used here as an indicator of richer, wetter, and more nitrogenous soils (i.e. well-manured) (Küster 1991, 20; Langer and Hill 1981, 197; Hanf 1983, 396-404; Grime *et al.* 1988, 190, 450). Also, Cyperaceae will be used as indicators of better-watered fields because species in this family grow well in moist or wet habitats (Cronquist 1981, 1139). Legumes are nitrogen-fixing, i.e. they are able to fix atmospheric nitrogen in their roots, and restore nitrogen levels in the soil (Langer and Hill 1981, 219-220; see also Grime *et al.* 1988, 568-574). For this reason species of the family Leguminosae can grow in nitrogen-deficient soils (Warington 1924, 119; King 1966, 150; Hanf 1983, 334). This family will be used here as an indicator of less-maintained fields and poor soils. Gramineae are within the Secaliatea group and are used as an indicator of less-fertile soils.

Figure 6.8 is a samples bi-plot of only the arable weed taxa from sites dated the AN in Cyprus and the AN and CN of the mainland Levant and Turkey. This plot represents the correlation between 49 samples and 44 arable weed taxa. The first axis accounts for 11.2% of the variation and the second axis represents 10% of the variation. This plot highlights the regional patterns illustrated above and shows similar distributions, with similarities between samples from Cyprus and western Syria and parallels between samples from the Euphrates Valley and Turkey.

Figure 6.8 CA bi-plot of arable weed taxa from sites located in the Cyprus and dated to the AN and from sites located in the Levant and dated to the AN and CN

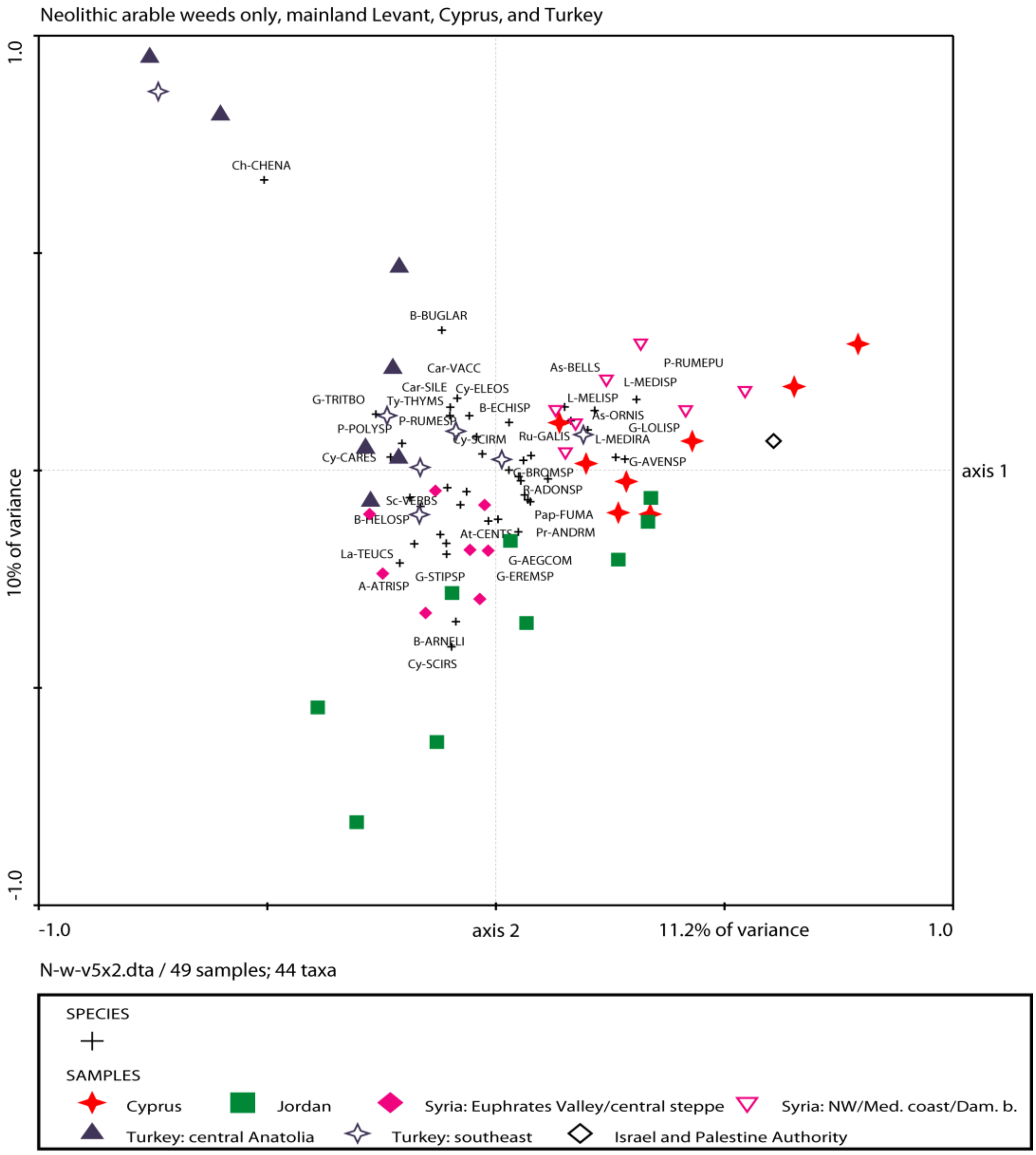


Figure 6.9 is an equivalent pie chart plot for the results of CA portrayed in **Figure 6.8**, which illustrates the comparative quantities of each arable weed taxa. The species were classified according to five plant families and a category of 'other families': Chenopodiaceae, Polygonaceae, Leguminosae, Gramineae, and Cyperaceae, with each family represented by a different colour with the exception of Chenopodiaceae and Polygonaceae which have been assigned the same colour based on similar ecological preferences. This pie chart plot indicates that species/genera of Gramineae are ubiquitous but that there is a greater representation of species/genera that belong to the Leguminosae family in samples from Cyprus and western Syria and a greater

representation of species/genera from Chenopodiaceae, Polygonaceae, and Cyperaceae in samples from Turkey and the Euphrates Valley. From this data it can be concluded that the samples from sites in Neolithic Cyprus and western Syria have poorer, less nitrogenous soils than the samples from sites located in Turkey and the Euphrates Valley; although further exploratory analyses are required to confirm the specific ecological associations.

Figure 6.9 CA pie chart plot of arable weed taxa from sites located in the Cyprus and dated to the AN and from sites located in the Levant and dated to the AN and CN

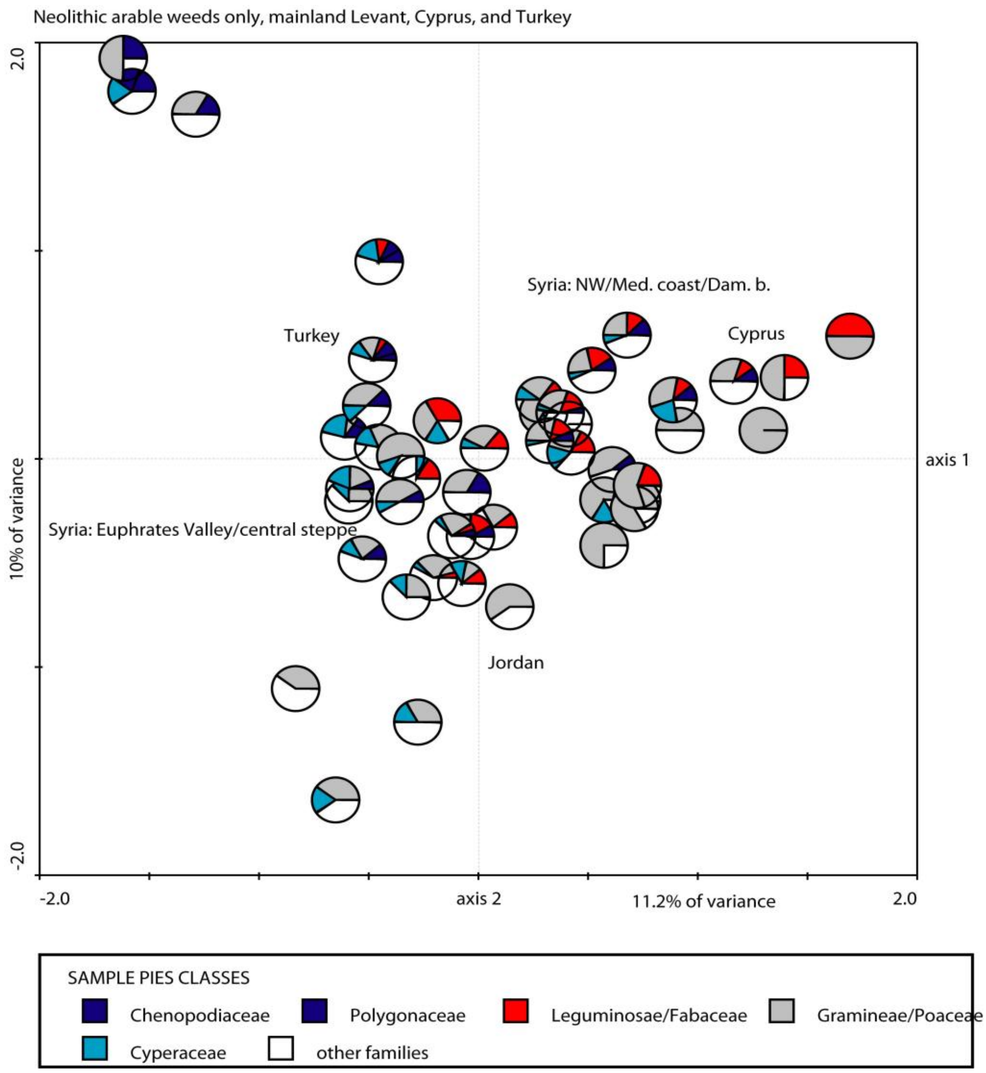
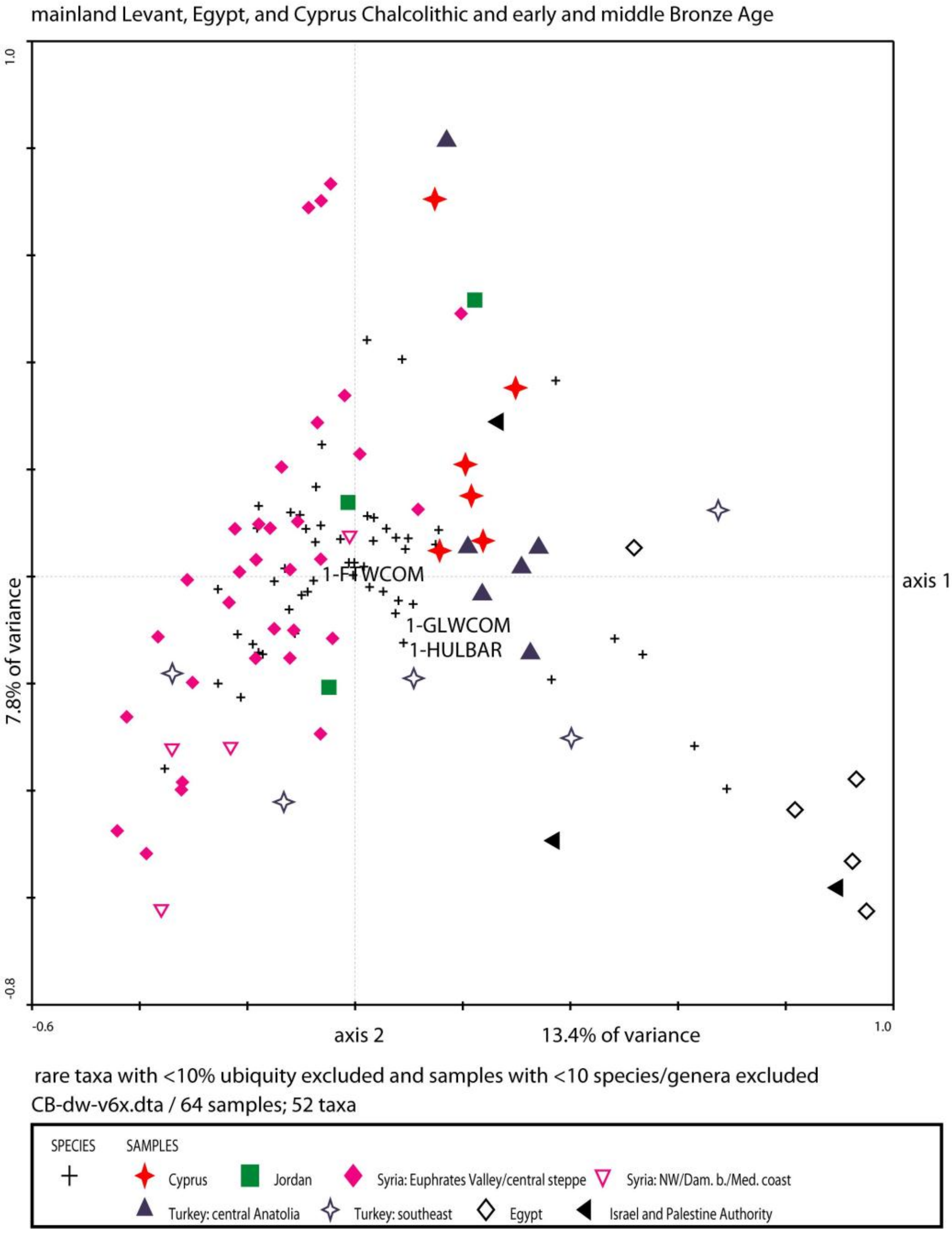


Figure 6.10 CA bi-plot of arable weed taxa and domesticated cereals and flax from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Chalcolithic and early and middle Bronze Age

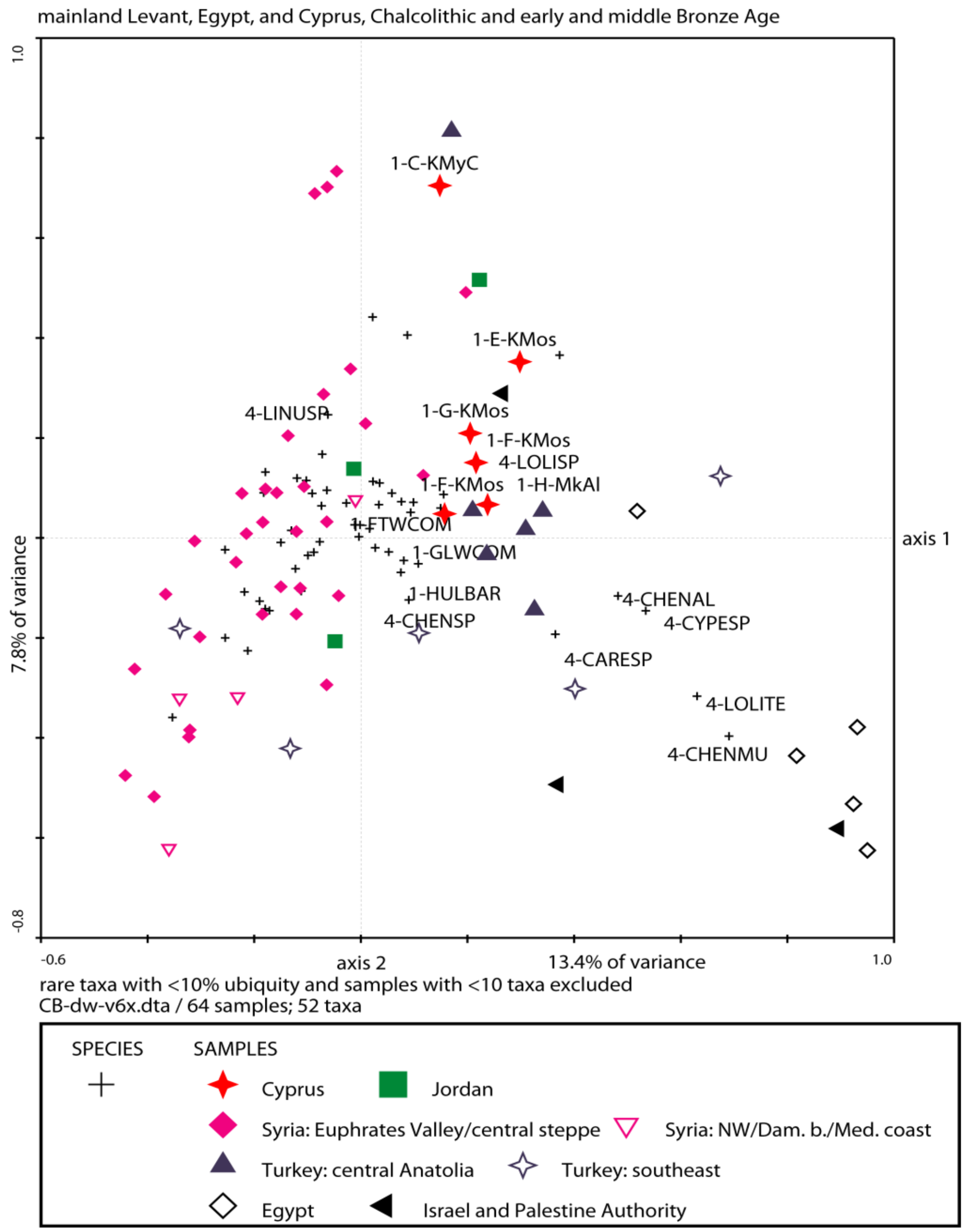


6.3.5 Comparative Chalcolithic and Bronze Age

This section presents the results of a comparative analysis of the data from the Chalcolithic and early and middle Bronze Age from sites located in Cyprus, Turkey, the Levant and Egypt. All samples in the following plots were classified according to country and region, with each country represented by a different color and each region a different symbol. **Figure 6.10** is a samples bi-plot of 64 samples and 52 taxa, which comprised arable weeds and domesticated cereals and flax. In this plot the locations of free-threshing wheat (FTWCOM), glume wheat (GLWCOM), and hulled barley

(HULBAR) are shown. The first axis represents 13.4% of the difference and the second axis represents 7.8% of the variation. This plot shows a clear separation between the samples from all regions of Syria and those from Egypt, Cyprus, and Turkey. The Syrian samples have negative values on the first axis and the other sites have positive values along this axis. Along the second axis there is a difference between the Egyptian, Cypriot and central Anatolian samples. The Cypriot samples have positive values on axis 2, the Egyptian samples have negative values, and the central Anatolian samples are pivotal between the two. **Figure 6.11** is the same bi-plot but with some of the species and sample labels that illustrate the relationship between samples and species, samples to samples, and species to species, and thus facilitates explanation of the patterning of samples in terms of taxonomic composition (i.e., the influence of crops and/or weeds on the regional groupings). This bi-plot reveals that free-threshing wheat (1-FTWCOM) is located near the point of origin and both glume wheat (1-GLWCOM) and hulled barley (1-HULBAR) have positive values on the first axis and are located in the lower right quadrant.

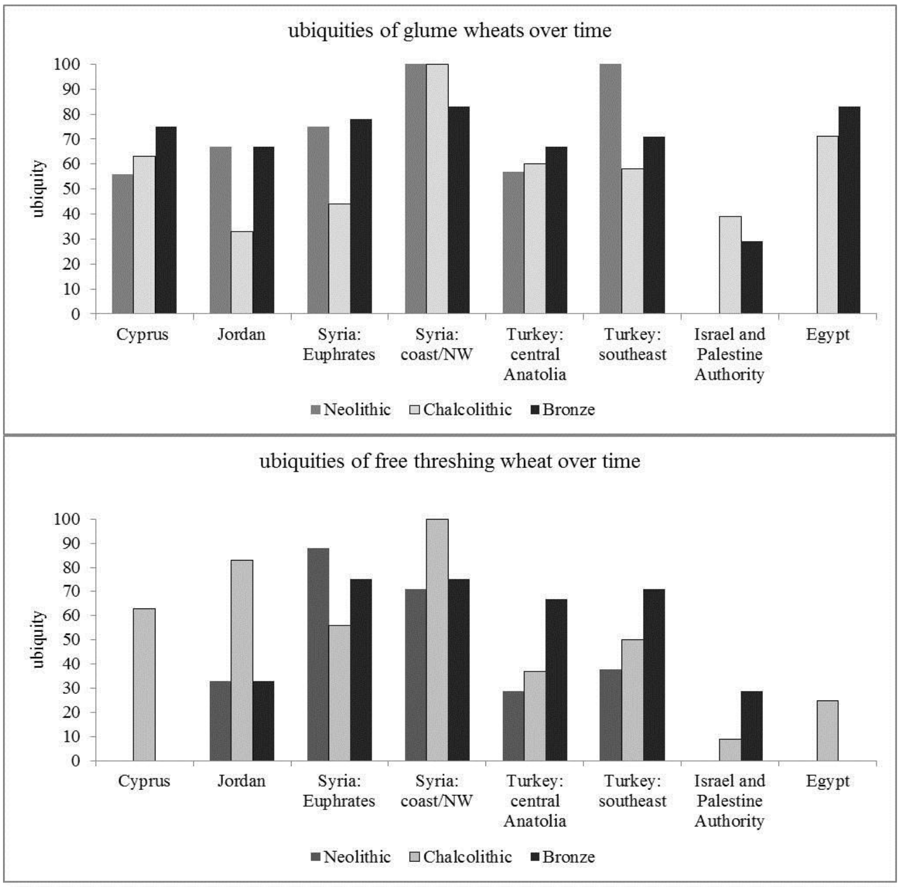
Figure 6.11 CA bi-plot of arable weed taxa and domesticated cereals and flax from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Chalcolithic and early and middle Bronze Age



Figures 6.12 and **6.13** are bar charts that show the ubiquities of wheat and barley for the Neolithic, Chalcolithic, and early and middle Bronze Age. Ubiquity was calculated as the percentage of the number of sites for each cultural and each region with evidence for each cereal crop. What is clear from these figures is that glume wheat and hulled barley were ubiquitous in all regions, although the frequency of occurrence varies. There is an increase in the frequency of occurrence of hulled barley in the Cypriot Chalcolithic (e.g. from 56% in the Neolithic to 100% in the Chalcolithic). Also there is an increase over

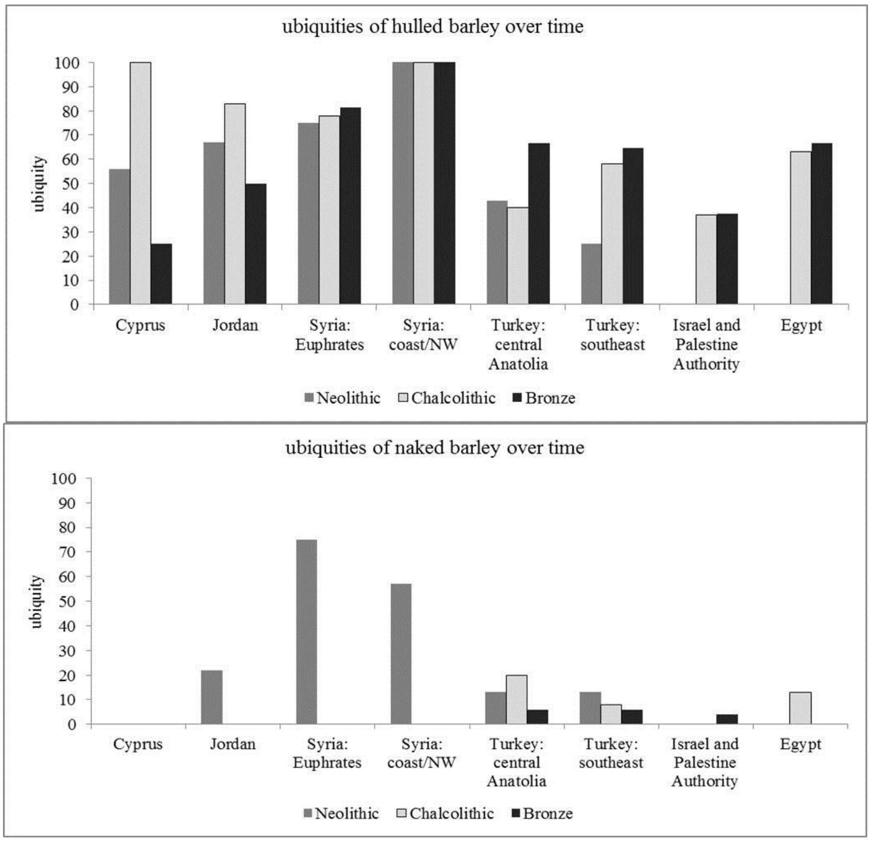
time in the Euphrates Valley, central Anatolia, southeast Turkey, and a slight increase in Israel and Palestine, and Egypt. Free-threshing wheat is less common than glume wheat and had the lowest ubiquity in Egypt in the Chalcolithic (25%). Naked barley is not as common as the other cereals and is more common in the samples from Neolithic, Chalcolithic, and Bronze Age Turkey; however, ubiquities are low and a slight decrease is noted for the southeast. In Syria, naked barley is common in the Neolithic and then disappears in the Chalcolithic and Bronze Age.

Figure 6.12 Bar charts of the ubiquities of the wheat crops in the Chalcolithic and early and middle Bronze Age from sites located in Cyprus, Jordan, Syria, and Turkey, Israel and Palestine Authority and Egypt



Number of Samples ('N' denotes Neolithic; 'C' denotes Chalcolithic; 'B' denotes Bronze Age): Cyprus: N (9), C (8), B (4); Jordan: N (9), C (6), B (6); Syria (Euphrates Valley): N= (8), C (9), B (32); Syria (western): N (7), C (1), B (6); Turkey (central Anatolia): N (7), C (5), B (6); Turkey (southeast): N (8), C (12), B (17); Israel and Palestine Authority: N (0), C (11), B (24); Egypt: N (0), C (8), B (6)

Figure 6.13 Bar charts of the ubiquities of the barley crops in the Chalcolithic and early and middle Bronze Age from sites located in Cyprus, Jordan, Syria, and Turkey, Israel and Palestine Authority and Egypt



Number of Samples ('N' denotes Neolithic; 'C' denotes Chalcolithic; 'B' denotes Bronze Age): Cyprus: N (9), C (8), B (4); Jordan: N (9), C (6), B (6); Syria (Euphrates Valley): N= (8), C (9), B (32); Syria (western): N (7), C (1), B (6); Turkey (central Anatolia): N (7), C (5), B (6); Turkey (southeast): N (8), C (12), B (17); Israel and Palestine Authority: N (0), C (11), B (24); Egypt: N (0), C (8), B (6)

It was suggested above that the regional differences could be based mainly on the arable weed assemblages. In the lower right quadrant of **Figure 6.11** the Egyptian sites are associated more closely with the following wild taxa: *Chenopodium album* (4-CHENAL), *Chenopodium murale* (4-CHENMU), *Lolium temulentum* (4-LOLITE), *Carex* sp. (4-CARESP), and *Cyperus* sp. (4-CYPESP). In the case of *Chenopodium album* and *murale*, the separation of these species could be a result of differences in individual archaeobotanists' identification criteria, particularly whether specimens were identified to the species or genus level. The CA was run on a dataset in which species of the same genus were combined and only the arable weed genera included (**Figure 6.14)**. The bi-plot represents the results of CA on a dataset comprising 94 samples and 53 genera. The first axis accounts for 10.8% of the variation and the second axis shows 6.9% of the variation. The relationships shown in **Figure 6.11** are maintained. Samples from Cyprus and central Anatolia have positive values on axis one, samples from Syria have negative values on axis one (in the lower left quadrant), and the Egyptian samples have positive values on axis one and negative values on axis two.

Figure 6.14 CA bi-plot of arable weed taxa from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Chalcolithic, and early and middle Bronze Age

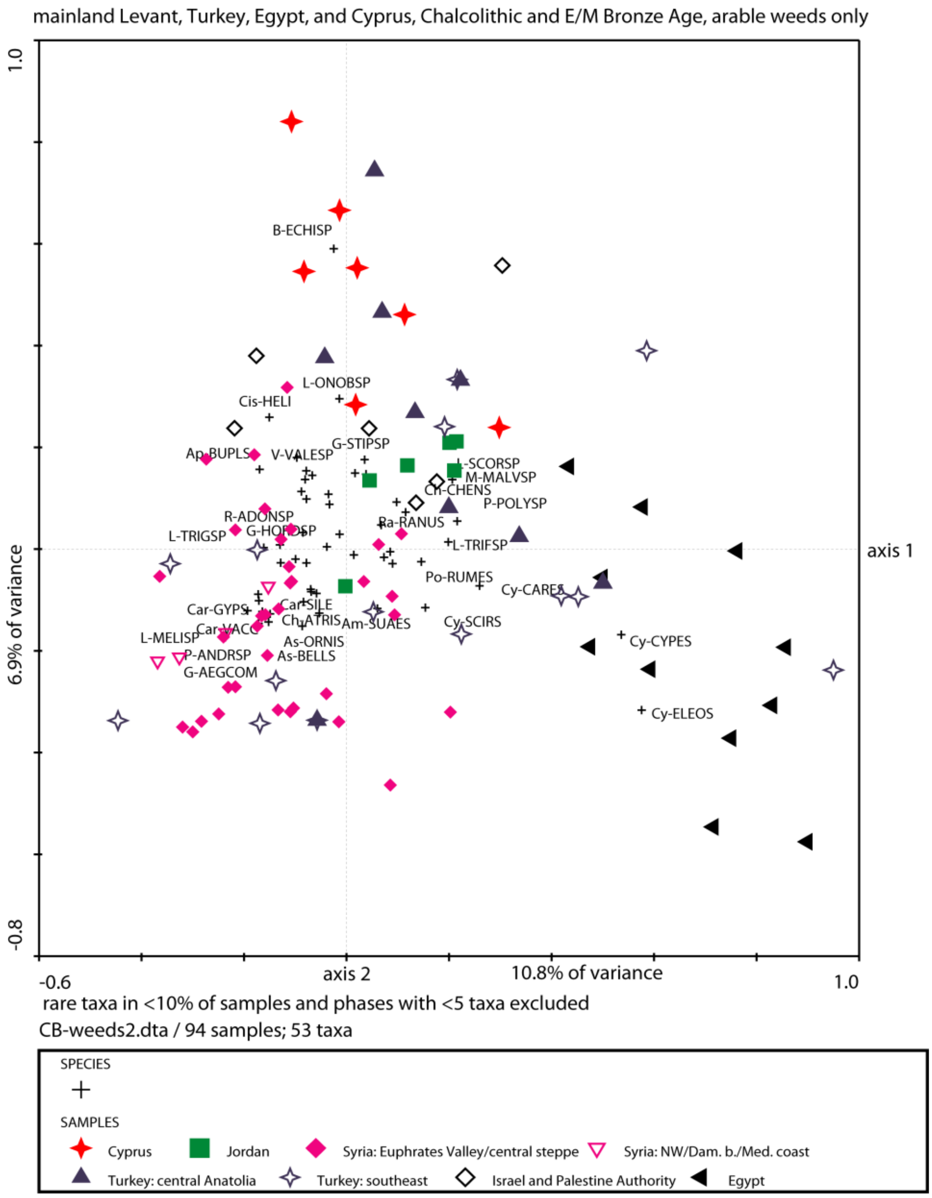
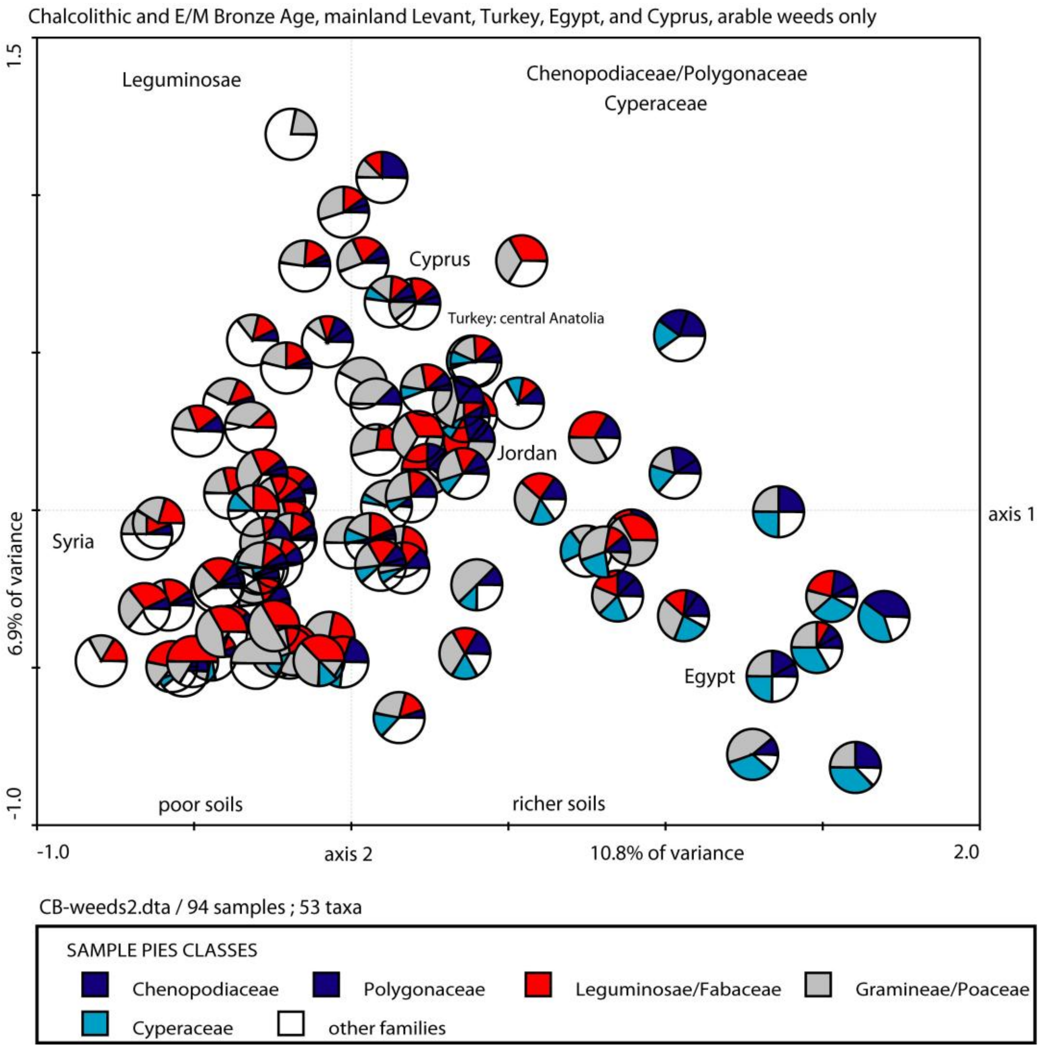


Figure 6.15 is a pie-chart plot. The species are classified according to the same six plant families as in the Neolithic comparative analysis and are represented by the same colour slices (i.e. Chenopodiaceae, Polygonaceae, Leguminosae, Gramineae, and Cyperaceae) (cf. **Figure 6.9**). A similar pattern is displayed which shows a separation between samples from regions with perhaps more poor versus rich soils. As above, the Syrian samples are associated with a greater representation of taxa in the Leguminosae family,

the Egyptian samples are associated with a greater proportion of wet ground genera in the Cyperaceae family as well as Chenopodiaceae and Polygonaceae, and the samples from Cyprus and central Anatolian have a greater representation of Leguminosae but with small proportions of Chenopodiaceae, Polygonaceae, and Cyperaceae.

Figure 6.15 CA pie chart plot of arable weed taxa from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Chalcolithic, and early and middle Bronze Age



In this analysis the data from the Chalcolithic and the early and middle Bronze Age was combined due to the limited number of samples from Cyprus. The patterns illustrated in the CA revealed regional patterning on the basis of the compositions of plant taxa. When the two cultural phases are analysed separately, the same patterns are shown. **Figures 6.16 and 6.17** are bi-plots based on the CA of datasets comprising arable weed genera for the Chalcolithic and early and middle Bronze Age, respectively. In the Chalcolithic period the samples from Cyprus cluster with the majority of the central

Anatolian sites. While, for the early and middle Bronze Age the samples from Cyprus are associated more closely with samples from southeast Turkey. However, there was only one early and middle Bronze Age site from Cyprus (Marki-*Alonia*) that was included in this plot due to the cut-off points. As discussed above, cut-off points (of rare taxa and small samples) have been successful in revealing patterns in the relationships between samples and taxa as the inclusion of both rare taxa and sites with small samples likely create noise and obscure patterns in the dataset. Additional data are needed from the Chalcolithic and Bronze Age of Cyprus, in particular, to better reveal regional patterns.

Figure 6.16 CA bi-plot of arable weed taxa from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Chalcolithic

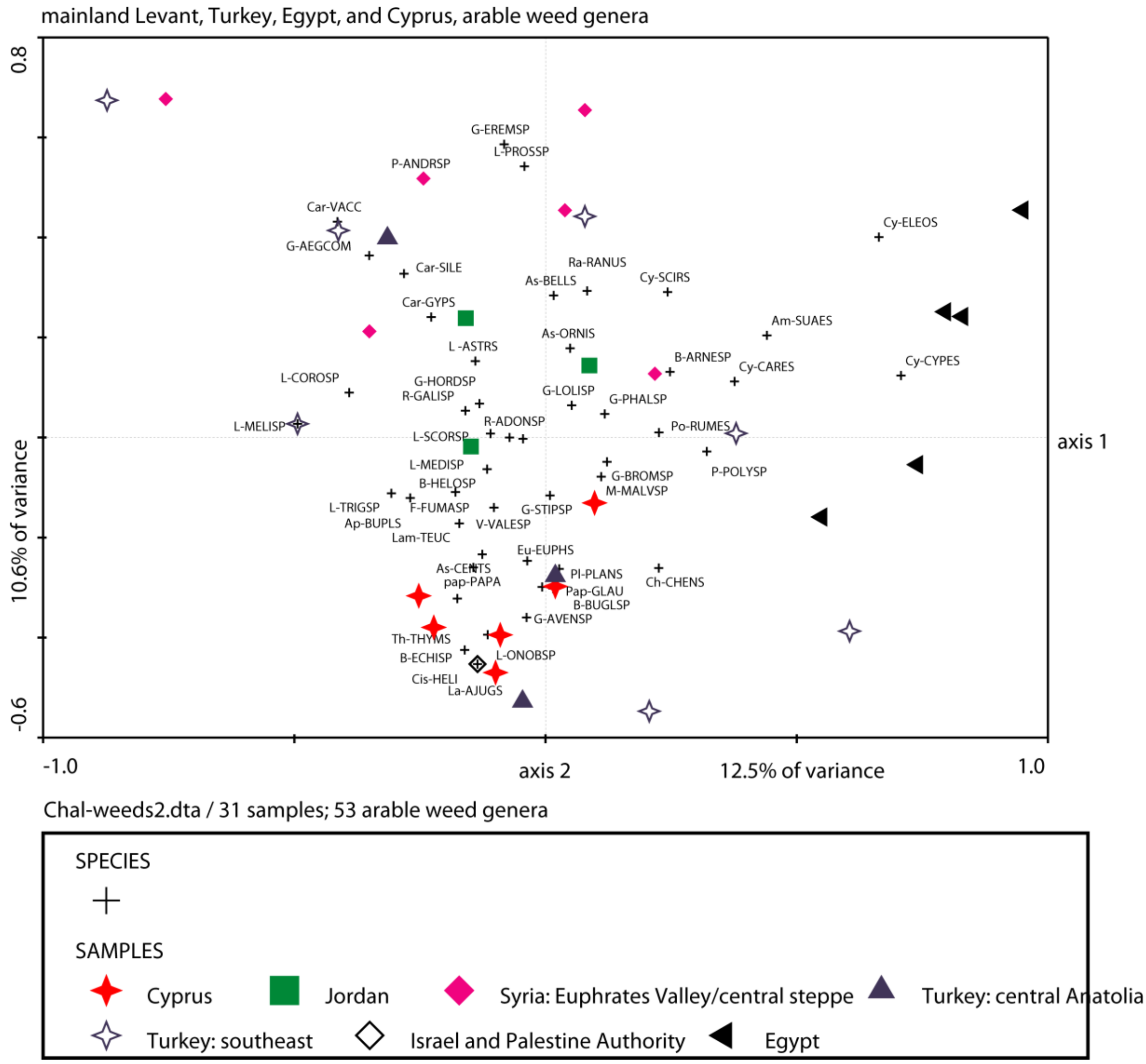
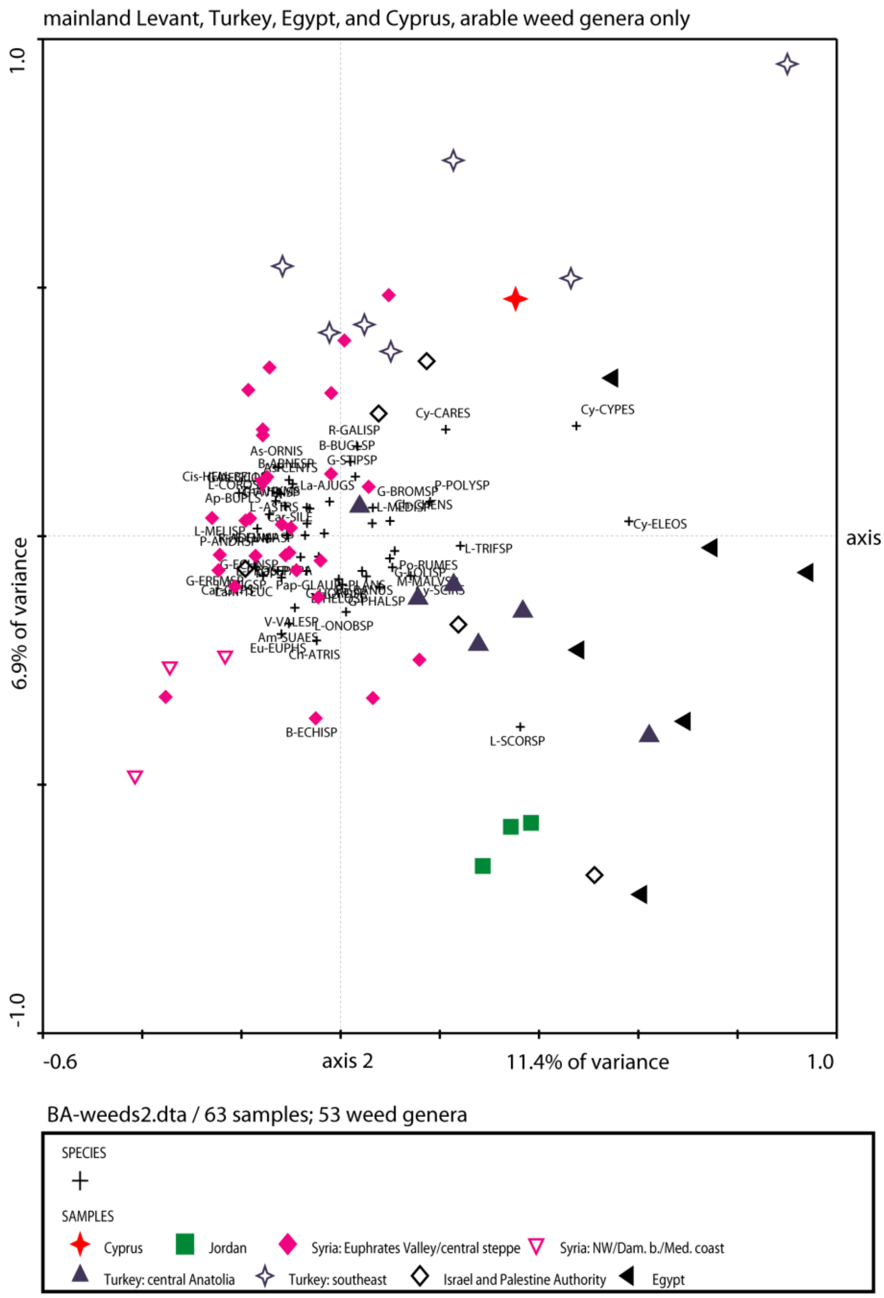


Figure 6.17 CA bi-plot of arable weed taxa from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the early and middle Bronze Age



6.3.6 Regional continuity in arable weeds

Above it was shown that there were regionally distinct patterns in the compositions of arable weed taxa. In this section the sites/phases will be compared on the basis of the arable weed taxa represented in order to identify regional continuity in weed assemblages over time, from the Aceramic Neolithic to the middle Bronze Age. The samples in these plots are classified according to country and region, with each country represented by a different color and each region a different symbol. **Figure 6.18** is a sample plot that shows the relationship between 136 samples and 55 genera. Rare taxa present in less than 10% of sites/phases and samples that had less than 5 taxa were excluded. The first axis accounts for 8.3% of the variation and the second axis represents 6% of the variation. This plot illustrates the same general pattern as was shown in the CA plots of the Neolithic and Chalcolithic/Bronze Age analysis. The majority of the Syrian sites have negative values on axis one and the majority of the samples from Cyprus, Turkey, Jordon, and Egypt have positive values.

Figure 6.18 CA samples plot of arable weed taxa from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Neolithic, Chalcolithic, and early and middle Bronze Age

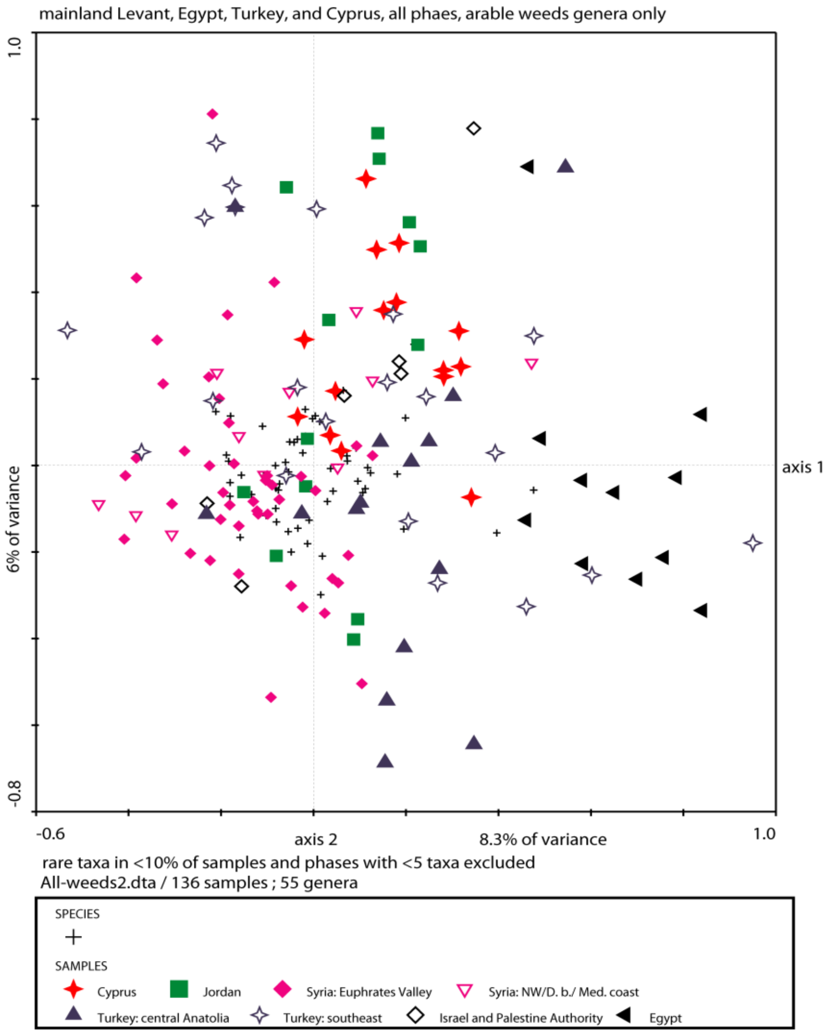
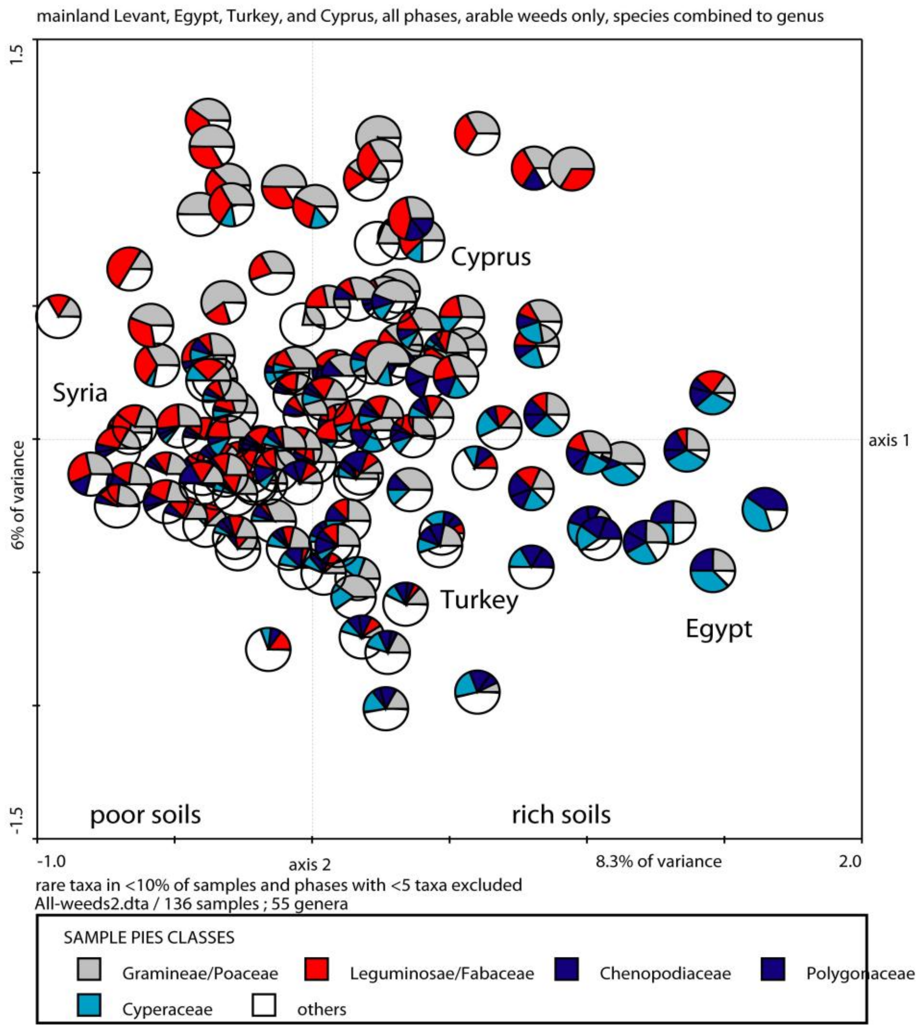


Figure 6.19 is the pie chart plot and it clearly illustrates regional continuity over time in the representations of plant families. Thus, a clear separation between the Syrian samples and samples from Egypt is noted, the former samples have negative values on axis one (i.e. mainly in the lower left quadrant) and the latter samples have positive values on axis one and negative values on axis two (i.e. in the lower right quadrant).

The first axis can be seen to represent a scale of soil fertility. The poorer soils have negative values on axis one and wetter and richer soils have positive values on this axis.

Figure 6.19 CA pie chart plot of arable weed taxa from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Neolithic, Chalcolithic, and early and middle Bronze Age

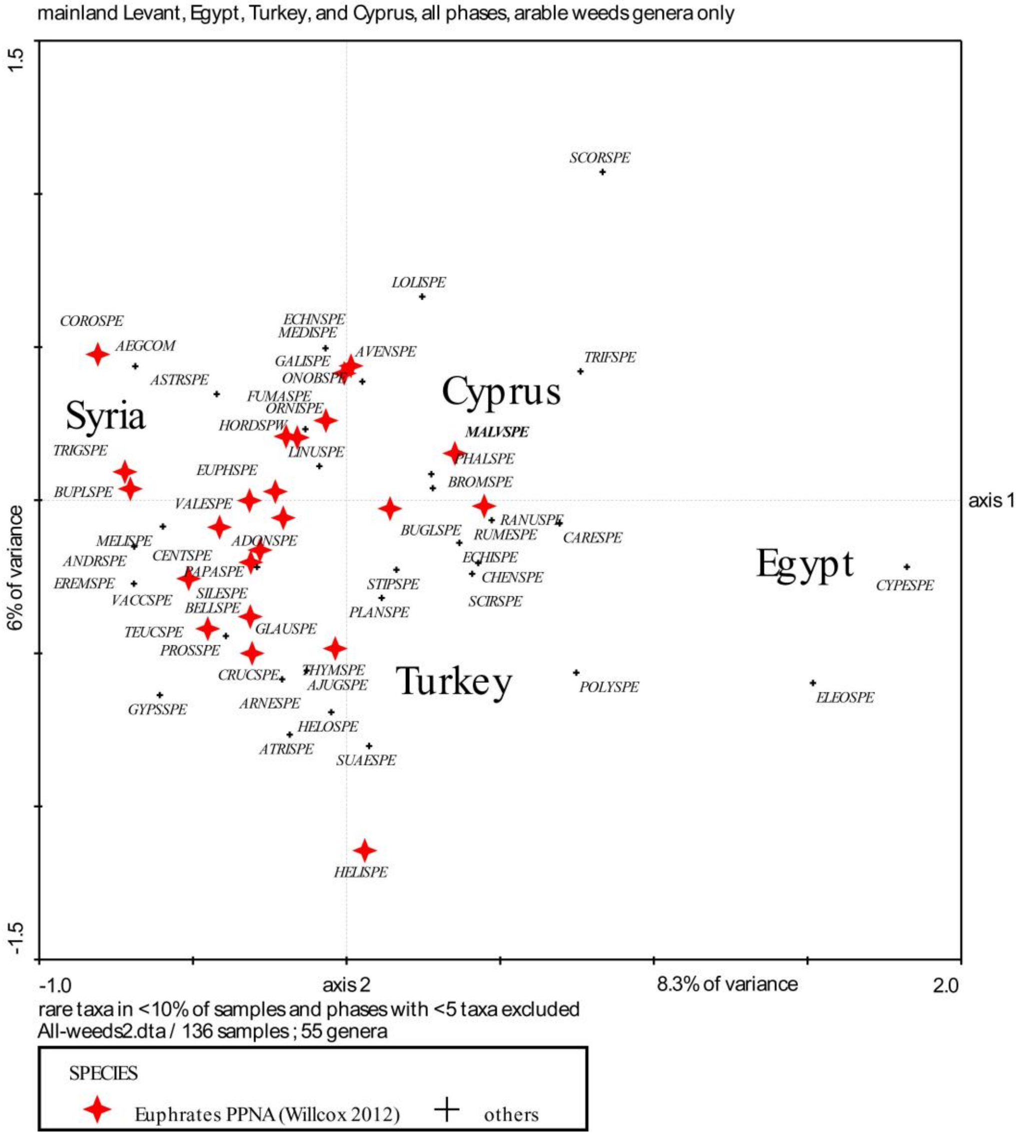


Willcox (2012) discusses the establishment of an arable weed assemblage in the Euphrates Valley during the PPNA and suggests possible continuity in this weed assemblage over time (**Table 6.2** provides a list potential arable weed taxa from early Euphrates valley sites discussed by Willcox (2012) and Hillman (2000)). The evidence supports regional continuity in the arable weed assemblage of the Syrian Euphrates sites. For example, a large number of weeds highlighted by Willcox (2012) and Hillman (2000) are presented in the Syrian sites that have negative values on axis one. **Figure 6.20** is a species plot in which the arable weed genera discussed by Willcox (2012) and Hillman (2000) are given different symbols to distinguish them from all other taxa. Of note also in this plot is the fact that the genera that are responsible for the separations of the Egyptian samples along the first axis are associated with moist soils (e.g. *Eleocharis*, *Cyperus*, *Polygonum*, *Carex*, *Chenopodium*, and *Scirpus*), which further supports the pattern described above.

Table 6.2 Table of the arable weeds in comparative analysis of all phases and all regions with those presented by Willcox 2012 denoted by "x" (these include the rare taxa that occurred at only one site). Genera listed by Willcox (2012) and not included in the analysis are Ononis, Camelina, Reseda, Convolvulus, Neslia, Isatis, Moluccella, Kickxia, and Turgenia. Also included and denoted by "" are the potential arable weeds discussed by Gordon Hillman (Moore et al. 2000)*

taxon	Willcox (2012) PPNA weeds	taxon	Willcox (2012) PPNA weeds
Adonis	x	*Heliotropium*	x*
Aegilops		*Hordeum sp.*	*
Ajuga		*Linum*	
Androsace		*Lolium*	*
Arnebia	*	*Malva*	x
Astragalus		*Medicago*	x*
Atriplex		*Melilotus*	
Avena	*	*Onobrychis*	x*
Bellevalia	x	*Ornithogalum*	x
Bromus	*	*Papaver*	x
Buglossoides	x*	*Phalaris*	
Bupleurum	x	*Plantago*	*
Carex		*Polygonum*	*
Centaurea	x	*Prosopis*	*
Chenopodium	*	*Ranunculus*	x
Coronilla	x	*Rumex*	*
Crucianella	x	*Scirpus*	*
Cyperus		*Scorpiurus*	
Echinaria		*Silene*	x
Echium		*Stipa*	
Eleocharis		*Suaeda*	*
Eremopyrum		*Teucrium*	x
Euphorbia	x	*Thymelaea*	x
Fumaria	x	*Trifolium*	*
Galium	x*	*Trigonella*	x*
Glaucium	x	*Vaccaria*	x
Gypsophila	*	*Valerianella*	x
Helianthemum			

Figure 6.20 CA species plot of arable weed taxa from sites located in the Cyprus, Turkey, Egypt, and the Levant and dated to the Neolithic, Chalcolithic, and early and middle Bronze Age



6.3.6 Summary of comparative analysis

The results of CA highlighted regional as opposed to chronological patterning in the dataset, with continuity in the plant assemblages for each region over time. The initial exploratory plot (**Figure 6.3**) showed an overall separation between samples from Syria and samples from Cyprus, Jordan, Turkey and Egypt. The samples were then analysed based on cultural periods. The cultural phases were divided into two broad cultural periods: 1) Neolithic and 2) Chalcolithic and early and middle Bronze Age.

Exploration of the Neolithic dataset revealed regional patterns. There is a clear separation between the arable weeds and domesticated cereals of samples from Aceramic Neolithic Cyprus and those from the surrounding regions. Although differences were highlighted, Cyprus in the Aceramic Neolithic showed greater similarity with western Syria. Differences between samples from Jordan, central Anatolia, and the Euphrates Valley were also shown. The distinctions were based on both the compositions and proportions of glume wheat, free-threshing wheat, hulled barley, and naked barley. A greater representation of glume wheat and hulled barley was associated with samples from Cyprus and western Syria and a greater representation of free-threshing wheat and naked barley with the other regions (Jordan, the Euphrates Valley, and Turkey). The separation between Cyprus and western Syria was based primarily on the absence of free-threshing wheat in the Cypriot Aceramic Neolithic samples. Differences in frequency of occurrence of the cereal crops were noted with greater frequencies of both hulled barley and glume wheat noted in Jordan and a higher frequency of glume wheat in southeast Turkey. Lentils were shown to be present in all regions. There are differences in the composition of legumes in each region: in central Anatolia there are more sites with chickpea, in Turkey (both regions) there are more sites with bitter vetch and pea, and in Cyprus, Jordan, and Syria there are low frequencies of chickpea, pea, and bitter vetch.

As above the sites/regions were also compared on the basis of the composition of the arable weeds and the analyses revealed the same regional patterns in the Neolithic data, with similarities between samples from Cyprus and western Syria and parallels between samples from the Euphrates Valley and Turkey. The arable weeds were explored separately and showed regional variations in the proportions of five plant families (Chenopodiaceae, Polygonaceae, Leguminosae, Gramineae, and Cyperaceae). Comparisons between regions showed differences in the compositions between plant families. Gramineae is common in all regions. There was a greater representation of Leguminosae in samples from Cyprus and western Syria; and a greater representation of Chenopodiaceae, Polygonaceae, and Cyperaceae in samples from Turkey and the Euphrates Valley.

The analysis of the Chalcolithic and early and middle Bronze Age data revealed similar regional separations. There are clear separations between the samples from Syria and those from Egypt, Cyprus, and Turkey. Regional differences are shown to be based more on the compositions of arable weed taxa then on the cereal crops. In particular there were differences once again in the ubiquity of free-threshing wheat and naked barley. Free-threshing wheat is represented far less frequently in Egypt and appears in both Cyprus and Egypt only in the Chalcolithic. Also, in Turkey a slight increase in the number of sites for each phase with free-threshing wheat was noted. Naked barley was not present in all regions and was more common in Turkey in the Neolithic, Chalcolithic, and Bronze Age in comparison to Cyprus, Jordan, and Israel and Palestine Authority. In Syria, naked barley is common in the Neolithic and then is absent in the Chalcolithic and Bronze Age.

The sites dated to the Chalcolithic and early and middle Bronze Age were compared on the basis of the composition of the arable weeds and the analyses revealed similarities between samples from Cyprus and central Anatolia. The species were again classified according to the same five plant families as in the Neolithic comparative analysis and a similar pattern was illustrated, which showed a separation between samples from regions with perhaps more nitrogen-poor versus nitrophilous and wetter soils, the Syrian samples were associated with the poorer soils and the Egyptian samples were associated with the wetter soils. As in the Neolithic, the Syrian samples were associated with a greater representation of taxa in the Leguminosae family, the Egyptian samples with wet ground genera in the Cyperaceae family as well as Chenopodiaceae and Polygonaceae, and Cyprus and central Anatolian had a mixture of both.

6.4 Cyprus Results

The results from an analysis of data from sites located in Cyprus and surrounding regions was presented above. The results showed that the taxonomic compositions of Cyprus in the Neolithic, Chalcolithic, and early and middle Bronze Age were regionally distinct. In this section the results of a comparative analysis of Cypriot data will be summarised. Also included in this section is a discussion of the tree/shrub/vine data from the island and a presentation of results of an analysis of the arable weed data, with a focus primarily on the evidence for seasonality and harvesting height.

6.4.1 Cereal Crops

The analyses above showed that the composition of cereal taxa in Cypriot prehistory is regionally distinct. Particularly noted are the low ubiquities of free-threshing wheat and naked barley for all phases. Evidence for free-threshing wheat prior to the Ceramic Neolithic at Ayios Epiktitos-*Vrysi* is limited (Hansen 1991; Colledge and Conolly 2007). Equivocal evidence for free-threshing wheat in the Aceramic Neolithic comes from Khirokitia-*Vounoi* and Dhali-*Agridhi*, present in 0.76% and 2% of samples, respectively (Hansen 1994, 2001; Willcox 2003, 237; Steward 1974; see also Colledge and Conolly 2007). In the Early and Middle Chalcolithic free threshing wheat is recorded at Prastio-*Agios Savvas*, Lemba-*Lakkous*, Kissonerga-*Mylouthkia*, and Kissonerga-*Mosphilia*. In the early and middle Bronze Age there is no evidence for free-threshing wheat; however, this could be due to the limited data available for this cultural period. In contrast at Kissonerga-*Mosphilia* the ubiquity of free-threshing wheat declines from the early and middle Chalcolithic (Periods 2/3) to the late Chalcolithic (Period 4); from 37% ubiquity in Period 2 to 1% ubiquity in Period 4 (Murray 1998). Additional archaeobotanical data from the early and middle Bronze Age is needed to fully address the importance of free-threshing wheat at this time. It is only during the Late Bronze Age that free-threshing wheat appears to replace glume wheat. Evidence of free-threshing in the Late Bronze Age comes from Hala Sultan-*Tekke*, Apliki-*Karamallos*, Maa-*Palaeokastro*, and Kalopsidha. There is no evidence of glume wheat in the Late Bronze Age.[8] Thus, based on current evidence, free-threshing wheat was introduced to the island either in the Khirokitian or during the Ceramic Neolithic, but did not become the more common wheat until the Late Bronze Age. Naked barley is

[8] The exception is a specimen at Hala Sultan-*Tekke* of either emmer wheat or spelt

rare in Cyprus. It is present in Neolithic samples recovered from Ayios Epiktitos-*Vrysi* and Dhali-*Agridhi*. In contrast, glume wheat is abundant in the archaeobotanical record of Cyprus (**Figure 4.4, Chapter 4**); in the Aceramic Neolithic both einkorn and emmer wheat were common. However, during the Chalcolithic proportional representation of einkorn decreases and the representation of emmer wheat and free-threshing wheat are similar. The numbers of sites in which hulled barley is represented increase from the Neolithic to the Chalcolithic but decrease in the early and middle Bronze Age.

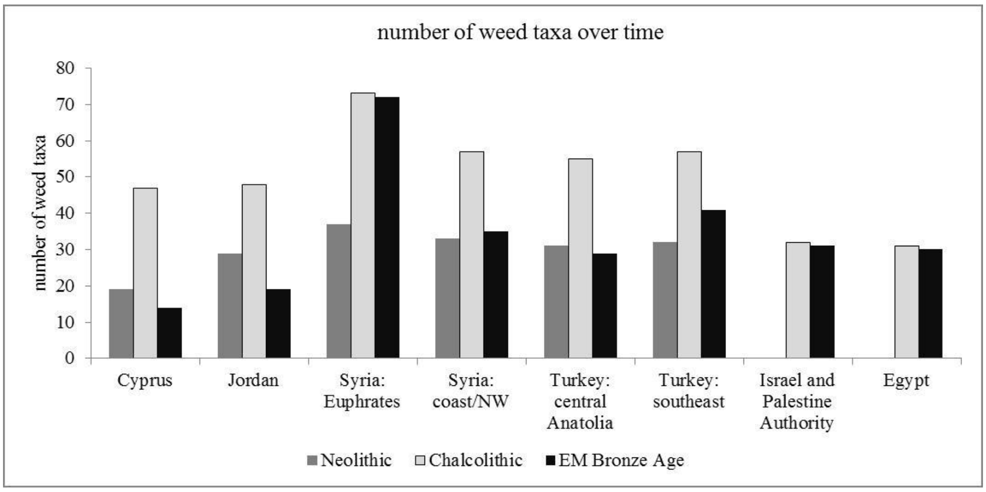
6.4.2 Legumes

Zohary and Hopf (2000, 92) consider pea, lentil, chickpea, and bitter vetch as the key principal legumes that were taken into cultivation with the main cereal crops, all four of which are present in the archaeobotanical of Aceramic Neolithic Cyprus (refer to **Figure 6.6** and **Figure 4.5, Chapter 4**). The number of sites with evidence for chickpea increases from the Aceramic Neolithic to the Ceramic Neolithic but then the number of sites decreases in the late Bronze Age. Although, the lack of evidence for the late Bronze Age could be due to the limited flotation efforts at excavations dated to this cultural period. In the Aceramic Neolithic, grass pea is common and then the number of sites with evidence for it decreases over time. Lentil is common in samples from all phases but its frequency decreases in the Bronze Age, again this is likely the result of lack of flotation from these sites. Faba bean (*Vicia faba*) is absent from the earlier cultural phases and then is introduced sometime during the Late Bronze Age.

6.4.3 Tree/Shrub/Vines

The evidence for trees, shrubs, and vines in the Cypriot archaeobotanical record suggests a staggered introduction of species and an increase in the number of taxa over time (**Table 4.4, Chapter 4**). In the Aceramic Neolithic there is evidence for capers, fig, pistachio, plum, grape, olive, pear, hackberry, and possibly apple (identification at Khirokitia-*Vounoi: Malus/Pyrus*). In the early and middle Bronze Age there is the first evidence of almond. However, nine tree species first appear in the archaeobotanical records during the late Bronze Age, possibly indicating that some or all were introduced to the island at this time. The taxa that were most likely introduced include *Citrus medica* (hereafter citron), *Punica granatum/Punica* sp. (hereafter pomegranate), *Ficus sycomorus* (hereafter sycamore fig), and *Pinus pinea* (hereafter stone pine). Plant species that grow on Cyprus include *Corylus avellana*, *Quercus* sp. (hereafter oak) (hereafter hazelnut), *Styrax officinalis* (hereafter styrax), *Ziziphus lotus*, and *Z. spina-christi* (hereafter Christ's thorn jujube) (Meikle 1977, 1985).

Figure 6.21 Bar chart that shows the number of weed taxa in the Neolithic, Chalcolithic, and early and middle Bronze Age



6.4.4 Arable Weeds

In Chapter 4, it was shown that there is an increase in wild taxa from the Aceramic Neolithic to the Late Bronze Age (refer to **Figure 4.3**) (see also Colledge and Conolly 2007), particularly the most obvious increase was from the Ceramic Neolithic to the Chalcolithic. This is also noted for Jordan, Syria, and Turkey. **Figure 6.21** (above) is a bar chart that shows the number of weed taxa in the Neolithic, Chalcolithic, and early and middle Bronze Age. In all regions, with the exception of Israel and Palestine Authority and Egypt for which there are no records, there was a significant increase in the number of wild arable taxa from the Neolithic to the Chalcolithic. For Cyprus there are more arable weed genera in the samples dated to the Chalcolithic (total 64) than any other cultural phase (42 genera in the Aceramic Neolithic, 31 in the Ceramic Neolithic, 23 in the early and middle Bronze Age, and 35 in the Late Bronze Age). **Table 6.3** lists the total number of taxa for each cultural phase, with each plant family represented (e.g. Leguminosae, Chenopodiaceae, etc.). As shown the plant families with the greatest representation are Leguminosae, Compositae, Boraginaceae, Chenopodiaceae, Liliaceae, Cyperaceae, Gramineae, and Polygonaceae. **Table 6.4** lists the percentage of each of the main plant families discussed in the first section of this chapter for each cultural period. Emphasized in this chart is an increase in the proportion of Leguminosae from the Ceramic Neolithic to the Late Bronze Age, from 9.67% to

17.14%. According to a table of percentages, the proportions of Chenopodiaceae and Polygonaceae are lowest in the Late Bronze Age and greatest in the Chalcolithic. This could represent an increase in agriculture in more nitrogen poor soils during the Late Bronze Age. A discussion of this will be included in the following chapter.

Table 6.3 List of the total number of genera classified by plant family for sites dated to the Aceramic Neolithic (AN), Ceramic Neolithic (CN), Chalcolithic (CHAL), early and middle Bronze Age (E/M BA) and Late Bronze Age (LBA) of Cyprus

Plant Family	AN	CN	CHAL	E/M BA	LBA
Ranunculaceae	2	2	1		
Papaveraceae	1	2	2	1	1
Brassicaceae	1	1	4		3
Cappparaceae			1		
Cistaceae			1		
Caryophyllaceae		1	2		
Malvaceae	1	1	1	1	1
Geraniaceae	1				
Oxalidaceae				1	
Leguminosae	8	3	7	1	6
Rosaceae	1				1
Cucurbitaceae					2
Umbelliferae	2	1			
Rubiaceae	1	2	3	1	1
Valerianaceae			1		
Compositae	1	4	3	5	4
Plumbaginaceae			1		
Primulaceae			1		1
Boraginaceae	3	1	3	1	4
Convolvulaceae			1		
Solanaceae		2	1	1	
Scrophulariaceae		1	1		
Lamiaceae			2	1	1
Plantaginaceae			1		
Amaranthaceae	1		1		1
Chenopodiaceae	2		5	1	1
Thymelaeaceae			1	1	
Euphorbiaceae		1	2	1	1
Liliaceae	3		3	1	2
Cyperaceae	4	1	2	1	1
Gramineae	8	6	11	4	4
Polygonaceae	2	2	2	1	

Table 6.4 List of the proportions of five plant families from the Aceramic Neolithic (AN), Ceramic Neolithic (CN), Chalcolithic (CHAL), early and middle Bronze Age (E/M BA) and Late Bronze Age (LBA) of Cyprus; figures are percentages

Plant Family	AN	CN	Chalcolithic	E/M BA	LBA
Leguminosae	19.04	9.67	10.93	5.55	17.14
Gramineae	19.04	19.35	17.18	22.22	11.42
Cyperaceae	9.52	3.22	3.12	5.55	2.85
Chenopodiaceae	4.76	0	7.81	5.55	2.85
Polygonaceae	4.76	6.45	3.12	5.55	0

6.4.4.1 Seasonality

Knowledge of sowing times of arable weed taxa can be useful in the determination of scheduling of agricultural practices (i.e. harvesting times) as well as provide insight into general agricultural productivity, as cereal crops sown in the autumn yield more grain (Hillman 1981, 146; see also Waston *et al.* 1936; Kirinde 1975). Given that weeds are likely included in archaeobotanical assemblages as a result of being harvested with cereal or pulse crops, the time of harvest can be inferred based on the flowering/fruiting times of the weed taxa. For seasonality in Cypriot prehistory, the *Flora of Cyprus* (Meikle 1977, 1985) was used. The flowering/fruiting of each species present was recorded at the genus level and calculated on the basis of the modal value for each genus. **Figure 6.22** is a bar chart that shows the distribution of the proportions of taxa (i.e. genera) that flower/fruit for each calendar month and for each cultural phase (the y-axis is labeled as the percentage of species) (refer to **Appendix 2** for flowering/fruiting data). The figure highlights an emphasis on early-flowering genera in all phases, with the highest percentage of genera flowering between March and May. Also noted is an increase over time in late flowering times, particularly between the months of June and September. The evidence for flowering times of the arable weed taxa suggests autumn-sowing and spring and early-summer harvesting of the crops.

Figure 6.22 Bar chart that shows the proportion of genera that flower or fruit during different months for each cultural phase in Cyprus

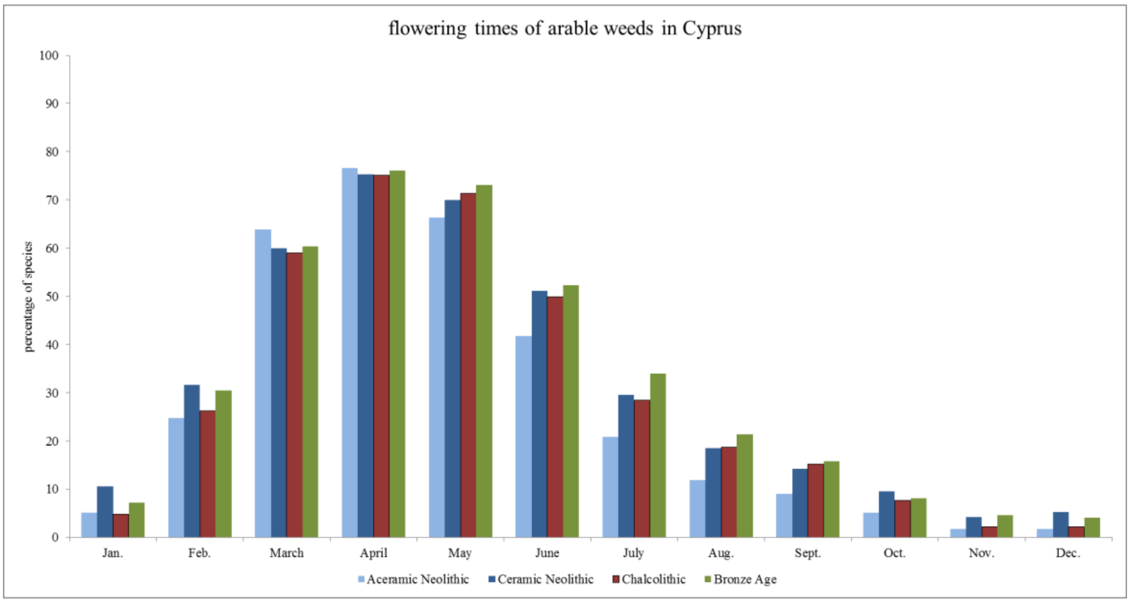
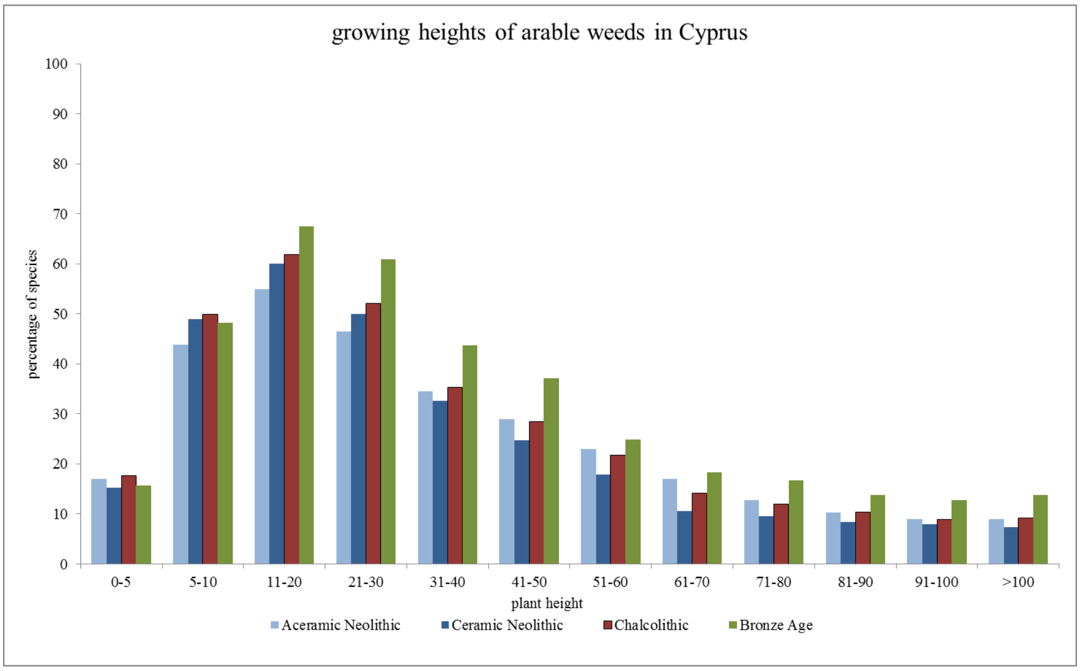


Figure 6.23 Bar chart of the proportions of growing heights of modern day weed species in Cyprus



6.4.4.2 Harvesting Height

The growing height of modern day weeds can be used to infer the harvesting height of crops in the past (Hillman 1981, 151). In the Bandkeramik (Phases III-V) of Neolithic Europe, Kreuz *et al.* (2005, 249-250) noted an increase in the presence of low-growing (~ 40 cm maximum height) weeds over time and related this to changes in harvesting techniques (following Kreuz *et al.* (2005, 249) low harvesting height is <40 cm, medium harvesting height is 50-80 cm, and high harvesting height >80 cm). For the averages of growing heights of arable weeds in Cyprus, the *Flora of Cyprus* (Meikle 1977, 1985) was used. The growing heights of each species present was recorded at the genus level and calculated on the basis of the modal value for each genus. **Figure 6.23** is a bar chart that shows the distribution as a percentage of the species that grow at various heights for each cultural phase (refer to **Appendix 2** for weed height data). A low harvesting height (i.e., <40 cm cf. Kreuz *et al*. 2005) can be inferred for all cultural phases since there is a greater proportion of low growing weeds in contrast to the low percentage of medium and high growing weeds. Noted also, is an increase from the Aceramic Neolithic to the Bronze Age in the percentage of low growing weed species, particularly in weeds that grow from 11-50 cm. Low- and medium-growing weeds are likely to be representative of harvesting cereals by cutting (e.g., with sickles) low on the culm as opposed to harvesting of the ears only (Kreuz *et al*. 2005, 249; see also Hillman 1981). Low-harvest height has also been associated with the reaping of free-threshing wheat (Hillman 1985, 6). Although this is unlikely to be the case for Cyprus since glume wheats dominate. The increase in the diversity of arable taxa with low growing heights from the Aceramic Neolithic to the Bronze Age could either be the result of the greater use of free-threshing wheat over time, or be indicative of the high utility of straw in Cypriot agro-pastoral systems, i.e. the straw was an important resource for animal feed.

6.6 Conclusions

This chapter presented the results of comparative analyses of the botanical assemblages from Cypriot prehistoric sites and contemporary sites located in the mainland Levant. Archaeobotanical data from Turkey, Syria, Jordan, Egypt, Israel and Palestine, dated to the Aceramic Neolithic (hereafter AN), Ceramic Neolithic (hereafter CN), Chalcolithic (hereafter CHAL), and early and middle Bronze Age (hereafter BA) were included in the CA. The objective of these analyses was to define regional and/or chronological similarities and/or differences between sites located in Cyprus and the surrounding regions. The results of CA highlighted regional as opposed to chronological patterning in the dataset, with continuity in the plant assemblages for each region over time. The patterns in the data illustrated a change in the regional similarities between Cyprus and the surrounding regions from the Neolithic to the Bronze Age. In the Aceramic Neolithic the taxonomic composition of Cypriot samples was most similar to those of samples located in western Syria (Northwest, Damascus basin/Mediterranean coast). However, the patterns in the data change during the Chalcolithic and early and middle Bronze Age. At this time the samples from Cyprus show closer parallels with those from sites located in central Anatolia. Also, included in this chapter was a summary of the Cypriot archaeobotanical data from sites dated to the Aceramic Neolithic, Ceramic Neolithic, Chalcolithic, and Bronze Age, in particular a summary of the crops and arable weed taxa was provided. In the subsequent chapter a synthesis and interpretations of the results will be presented.

Chapter 7

Interpretations, Conclusions, and Suggestions for Future Research

7.1 Introduction

Having presented the results of the analyses of the botanical remains from four diachronic sites on Cyprus and the results of comparative analyses of plant material from the mainland Levant, Turkey, Egypt and Cyprus, dating to the Aceramic Neolithic to the early and middle Bronze Age, the research questions of this thesis will be addressed and interpretations of the data offered. The research questions outlined in the introduction of the thesis focused on whether there were regional and/or chronological patterns in the crop and weed assemblages of Cyprus and the mainland Levant. To be addressed in this chapter is what the patterns in the taxonomic compositions of plant material reveal about the interaction between Cyprus and surrounding regions over time with regards to the spread of agriculture to the island, multiple crop introductions, and local agricultural developments, i.e., intensification (both pre-harvest and post-harvest), and extensification. The chapter will end with a conclusion of the thesis and suggestions for future research.

7.2 Regionalism in Near Eastern Archaeobotany

Chapter 6 presented the results of comparative analyses of charred plant material from Cyprus, the mainland Levant, Turkey, and Egypt. Correspondence analysis (hereafter CA) of the domesticated cereals and wild arable weeds revealed regional as opposed to chronological patterns in the compositions of plant taxa, with continuity in the plant assemblages, particularly the arable weeds, for each region over time. The patterns in the data illustrated a change in regional similarities of the taxonomic compositions between samples from Cyprus and the surrounding regions from the Neolithic to the Bronze Age.

In the Aceramic Neolithic the wild arable taxa and domesticated cereals of samples from Cyprus were most similar to those from samples located in western Syria (Northwest, Damascus basin/Mediterranean coast); although differences between the two regions were noted. Specifically, Cyprus had very little evidence for free-threshing wheat and naked barley at this time. In contrast, there was a greater representation of free-threshing wheat and naked barley from samples from Jordan, the Euphrates Valley and Turkey (southeast and central Anatolia). With regards to the arable weeds, there was a greater representation of Leguminosae in samples from Cyprus and western Syria; and a greater representation of Chenopodiaceae, Polygonaceae, and Cyperaceae in samples from Turkey and the Euphrates Valley. The plant families Chenopodiaceae and Polygonaceae are within the phytosociological syntaxa, Chenopodietea, and are used here as indicators of richer, wetter, and more nitrogenous soils (i.e. well-manured) (Grime *et al.* 1988, 190, 450; Hanf 1983, 396-404; Küster 1991, 20; Langer and Hill 1981, 197). Also, Cyperaceae are used as indicators of better-watered fields because species in this family grow well in moist or wet habitats (Cronquist 1981, 1139). In opposition, the family Leguminosae can grow in nitrogen-deficient soils and is used here as an indicator of less-maintained fields and poor soils (Hanf 1983, 334; King 1966, 150; Warington 1924, 119). The analyses of the Neolithic data highlight a correlation between more nitrogenous, rich and wet soils (e.g., well-manured) with the cultivation of free-threshing wheat and poorer, less nitrogenous soils with the cultivation of glume wheat. Thus, the Cypriot preference for glume wheat during the Neolithic may relate to agriculture on more nitrogen poor soils. Further, glume wheat (both einkorn and emmer wheat) is known to grow well in un-irrigated fields and both are highly resistant to drought and poor soils. In contrast, free-threshing wheat grows better on irrigated soils that are richer, more fertile, and nitrogenous (Charles 1985, 25; Kreuz et al. 2005, 253; see also Körber-Grohne 1988; Kreuz 2004; Percival 1921).

The patterns that were highlighted in the CA showed a change in similarities between the taxonomic compositions of Cyprus and the surrounding regions. The Neolithic samples were more regionally distinctive than the samples from sites dated to the Chalcolithic and early and middle Bronze Age. In contrast to similarities with western Syria during the Neolithic, the samples from Cypriot sites dated to the Chalcolithic and early and middle Bronze Age show closer parallels with those from sites located in Turkey, particularly central Anatolia. When the Chalcolithic and early and middle Bronze Age were analysed separately, the early and middle Bronze Age (Marki-*Alonia*) was most similar to sites located in southeast Turkey; though more botanical data is needed from the early and middle Bronze Age of Cyprus to better compare the Cypriot data with surrounding geographical regions. While similarities between samples from sites located in Cyprus and the surrounding regions change over time, there is consistency in the arable weed assemblages for each region.

Willcox (2012) discusses the possibility of the establishment of an arable weed assemblage in the Euphrates Valley during the PPNA. The analyses presented here support regional continuity in the arable weeds from PPNA Euphrates Valley; with many of the arable weeds present in samples from the PPNA also in the samples in later periods. Furthermore, the arable weed data from samples dated to the Chalcolithic and early and middle Bronze Age highlight the same general patterns with regards to representations of the plant families discussed (e.g., Chenopodiaceae, Polygonaceae, Cyperaceae, Leguminosae, and Gramineae). There is a greater representation of taxa in the Leguminosae family in the Syrian samples and a greater proportion of wet ground genera (Cyperaceae, Chenopodiaceae, and Polygonaceae) in the Egyptian samples. In Cyprus there was a greater representation of Leguminosae with small proportions of the nitrogenous and wet-ground species. Thus, there is continuity over time of agriculture in more poor, less-nitrogenous soils in Syria and Cyprus and agriculture in more nitrogenous, moist soils in Turkey and Egypt. Interpretations of the arable weed data discussed here are only preliminary as analyses of the weed data were on a more general level, i.e. on the level of plant families and phytosociological syntaxa. Further analyses of the phytosociology of the weed species, and possibly the analyses of functional attributes (e.g., by FIBS methods) are desirable to better understand regional patterns in the arable weed assemblages. Additional explanations for the greater proportion of glume wheat in Cypriot prehistory are discussed below.

In the introductory chapter of this thesis the research questions were outlined. With regards to regional patterns in the data, the aim was to address the meaning of these patterns and discuss any contributions to debates on island contact, the emergence of social complexity, and the development of the Cypriot Late Bronze Age economy. The first part of this section will focus on the Neolithic Period. The evidence for interaction with the broader Near East with regards to the spread of agriculture to the island will be discussed. The second part will deal with the development of agriculture in Cyprus and the impact of the broader Mediterranean interaction sphere on local agricultural developments during the Chalcolithic and the early and middle Bronze Age.

7.3 The Cypriot Interaction Sphere during the Neolithic

At this time there are no archaeobotanical data from the Akrotiri Phase or the Cypriot PPNA. However, evidence of island exploration during both cultural phases is presently being established (see section 2.3.2 and 2.3.3). Botanical data from excavations at Ayios Tychonas-*Klimonas* (Vigne *et al.* 2012) and Ayia Varvara-*Aetokremnos* has the potential to change what is known about the economy of the earliest explorers and perhaps colonists to the island. As stated in the introduction, the dispersal story of agriculture to Cyprus is one of demic diffusion, more specifically a targeted migration by farming populations from the mainland Levant in the Early PPNB (Colledge *et al.* 2004; Peltenburg *et al.* 2000; 2003; Guiliane and Briois 2001; Willcox 2003). However, botanical data from recent and ongoing excavations from PPNA sites on Cyprus could change the currently held paradigm. Nonetheless, there is evidence for a wide regional interaction sphere during the PPNA, with archaeological data from this period showing interactions with central Anatolia (obsidian), the Red Sea (marine shells), and the Euphrates Valley (parallels in the chipped stone tool technology and stone shaft-straighteners) (Bar-Yosef 2001, 37; Simmons 2004; Manning *et al.* 2010) (refer to section 2.3.2).

7.3.1 The Spread of Agriculture to Cyprus in the PPNB

During the Cypro-PPNB there is substantial evidence for a migration of farmers to the island (Colledge *et al.* 2004; Lucas *et al.* 2012; Peltenburg *et al.* 2000; Peltenburg *et al.* 2003; Vigne *et al.* 2011; Willcox 2003). The extent of interaction between the farmers and any residual hunter-foragers in Cyprus is not known at this time. Additional data from Cypriot PPNA and PPNB sites are needed in order to fully address this issue. Nevertheless, parallels between the mainland and Cyprus during the migrating period are well-established, with evidence from different sites demonstrating analogies with different sub-regions on the mainland. Similarities have been suggested between Cyprus and the northern Levant **(**Peltenburg *et al.* 2000; 2001; 2003, 95), the southern Levant (Simmons 2004, 11; Colledge *et al.* 2004; see also Colledge and Conolly 2007), southeast Anatolia (Willcox 2003, 235-237), and more recently the Euphrates valley (Lucas *et al.* 2012). One of the major questions archaeologists sought to answer previously regarded the origin of the island's early colonists (Willcox 2003; Hansen 2001). However, interpretations from recent data reveal that the answer to this question is much more complex and the evidence suggests a small, staggered influx of farming groups from multiple sub-regions in the mainland Levant.

7.3.2 Staggered Species Introductions

The CA exposed clear differences between the domesticated cereals and arable weeds for all regions during the Neolithic. The strength of these regional patterns was weak, with most of the variation represented by low percentages of variance. However, this is not entirely surprising seeing as the sub-regions analysed, including Cyprus, were part of the spread of the early Near Eastern agricultural ‘package’. Thus, some similarities in the compositions of plant taxa were to be expected. This package includes the founder crops of domestication in this region, i.e. einkorn and emmer wheat, barley, lentil, pea, chickpea, bitter vetch, and flax (Zohary and Hopf 2000; Weiss and Zohary 2012, S237). It was mentioned earlier (section 1.3) that the crops and animals did not spread as a complete ‘package’ as such, but rather each species has its own domestication and dispersal story (Conolly *et al.* 2011; Colledge *et al.* 2004; Vigne; 2008; Zeder 2008). This is true for the spread of the agricultural crop ‘package’ to Cyprus as well.

In the early Cypro-PPNB three cereal crops are present in the archaeobotanical record (Willcox 2003; Peltenburg *et al.* 2003), emmer and einkorn (one-grained) wheat and barley (Perekklisha-*Shillourokambos* and Kissonerga-*Mylouthkia*). In the middle to late Cypro-PPNB, two-grained einkorn was added to the Cypriot botanical assemblage (Krittou Marottou-*‘Ais Yiorkis*) (Lucas *et al.* 2012) (see section 5.2.3). There is limited evidence for the introduction of free-threshing wheat (Dhali-*Agridhi* and Khirokitia-*Vounoi*), naked barley, and chickpea (Dhali-*Agridhi*) during the late Aceramic Neolithic (Khirokitian) (see section 6.4.1 and 4.6.4). In the Ceramic Neolithic (Ayios Epiktitos-*Vrysi*) there is clear evidence for the introduction of free-threshing wheat, naked barley, chickpea, grass pea, and domesticated flax. During the Chalcolithic and early and middle Bronze Age there are no new cereal or pulse crop introductions. However, there is evidence for the introduction of faba bean and multiple tree crops in the Late Bronze Age including citron, sycamore fig, stone pine, and pomegranate.

The archaeobotanical data is similar to the Cypriot faunal evidence, which is suggestive of multiple introductions from the mainland from the earliest settlers to the Late Bronze Age. **Figure 7.1** is a time line that shows the major plant and animal introductions to Cyprus from the Aceramic Neolithic to the Late Bronze Age. Also represented in this timeline are the major changes in architecture and material culture from excavated sites located in Cyprus. Further, like animal introductions to the island, each crop has its own trajectory. For example, cattle were introduced to the island in the Cypro-PPNB and then disappear from the archaeological record by the Khirokitian not to appear again until the Bronze Age (Croft 1991; Simmons 1998; Sevketoglu 2000; Vigne *et al.* 2000). Mesopotamian fallow deer are introduced in the Cypro-PPNB and thereafter become the most significant faunal resource; although, its importance varies over time. The controlled exploitation and hunting of deer begins in Cypro-PPNB, increases during the Ceramic Neolithic and early Chalcolithic and then decreases in importance after the Middle Chalcolithic (Croft 1991). Interestingly, the decrease in importance of hunting of deer possibly coincides with the increase in free-threshing wheat from the Chalcolithic onwards. This will be explored more fully below.

The Cypro-middle PPNB is considered a period of amalgamation and contact with the mainland which is followed by a supposed decrease in external contact (Peltenburg 2004, 72). The archaeobotanical evidence suggests continued contact during the middle Cypro-PPNB, the late Cypro-PPNB, the Khirokitian, and the Ceramic Neolithic on the basis of new crop introductions; two-grained einkorn, free-threshing wheat, and naked barley. With regards to architecture, social hierarchy, burial practices, and pottery production, Cyprus diverted from the mainland cultural trajectory during the late Cypro-PPNB. The distinctive Cypriot culture reached its full expression in the Khirokitian (le Brun 2001). The island maintained its use of circular domestic architecture when the architecture of the mainland changed from circular structures to rectangular multiple-lime stone plastered floor-buildings. Also there is no evidence of pottery production in Cyprus until the Ceramic Neolithic, which coincides with the end of the mainland Pottery Neolithic. In sum, the Neolithic botanical data of Cyprus is suggestive of interaction between Cyprus and the mainland. More specifically, there is evidence for multiple introductions of crops from the mainland during the Neolithic. Although Cyprus participated in the Near Eastern interaction at this time, the archaeological (e.g., circular domestic architecture, chipped stone, and pottery) and botanical data are suggestive of the development of a distinct Cypriot Late Neolithic culture, which has been attributed to low population density and a lack of inter-group competition (Clarke *et al*. 2007; Peltenburg 2004b, 83).

7.4 The Cypriot Interaction Sphere during the Chalcolithic and Bronze Age

Archaeological evidence for increasing external contact in Cyprus comes from the Late Chalcolithic. It is at this time that there is evidence for increasing external contact and the island goes from relative isolation and independence to integrating into the broader Mediterranean interaction sphere (Peltenburg *et al.* 1985). Discussed in this section is the evidence for agricultural developments and interaction between Cyprus and the mainland Levant, Turkey, and Egypt during the Chalcolithic and early and middle Bronze Age.

7.4.1 Agricultural Intensification, Extensification, and De-Intensification in Cyprus

This section includes a discussion of the evidence for agricultural intensification and extensification in Cyprus. Previously proposed models for early Near Eastern agricultural practices included a transition from an intensive mixed farming system of autumn-sown crops on fixed plots with high inputs of labour (tillage, weeding and manuring) to flood-water farming and then to plough-based agriculture with greater woodland clearance (extensification) and large-scale irrigation systems (Bogaard 2004, 2005; Halstead 1987; Sherratt 1980). Cyprus contributes to discussions on intensive mixed farming regimes, with evidence for this practice on the island by the end of the ninth millennium BC (Bogaard 2004; Peltenburg *et al.* 2001). This practice involves the integration of small-scale intensive garden cultivation and intensive livestock herding, with mutually exclusive benefits for both livestock and crops. The benefits for the crops are that the animals provide manure for soil fertilization (whether collected manually or as a result of grazing) and they help with tillage. The benefits for the animals are that the crop by-products from processing can be used as fodder (Bogaard 2005). Unfortunately there are limited botanical data that provide direct evidence for pre-harvest intensification, i.e. tillage and manuring; although intensive methods of field maintenance (tillage) as a form of risk-buffing has been suggested for the Cypro-PPNB (Colledge and Conolly 2007). Further, inferential evidence for manuring comes from the integration of livestock and early farming villages.

Analyses of the Cypriot arable weed assemblage are suggestive of agriculture in new areas with evidence for an increase in the number of weed taxa from the Aceramic Neolithic to the late Bronze Age, with a significant increase in the Chalcolithic. This can be interpreted as evidence for extensification, more specifically expansion of agricultural fields into new areas (see also Murray 1998). This is also evident in the early and middle Bronze Age when there is a shift in settlement location into new regions, i.e. areas that receive less rainfall and have poorer quality soils. This correlates with the arable weed data presented in the previous Chapter that revealed an increase in weeds in the Leguminosae family at this time. The reasons for this increase could be due to the nature of the soils in the newer areas or as a result of soil depletion due to the heavy use of the land. Additional evidence for extensification comes from an increase in stone tool axes and the introduction of the cattle-drawn plough in the early Bronze Age (Frankel and Webb 2006; Peltenburg *et al.* 2003). The evidence from the arable weeds in Cyprus for sowing times and harvesting height will be now discussed followed by an interpretation of the data for post-harvest intensification and diversification in crops.

Knowledge of sowing times of arable weed taxa can be useful in the determination of general scheduling of agricultural practices and productivity, as cereal crops sown in the autumn yield more grain (Hillman 1981, 146; see also Waston *et al.* 1936; Kirinde 1975) (refer to section 6.4.4.1). The arable weed data are useful indicators of harvesting time since the weeds are likely included in the archaeobotanical assemblage as a result of being harvested with the cereal or pulse crops. The flowering/fruiting times of the arable weed data from Cypriot sites dated to the Aceramic Neolithic to the Late Bronze Age are suggestive of autumn-sowing and spring- and early summer-harvesting of crops. The largest concentrations of flowering/fruiting times noted were between March and May, which is consistent with autumn-sowing and spring-harvesting. While this dominance of spring flowering and fruiting persists through all periods, there is an increase over time in taxa with late summer flowering/fruiting times. Thus, there were more weed species that flower/fruit between the months of June and September in the Late Bronze Age than in the Aceramic Neolithic. This could indicate some late summer-harvesting of crops and that the farmers were more flexible with harvest times of some fields or crop varieties. It could also indicate some cultivation of spring-sown summer crops, although clear evidence for the irrigation necessary for such a cropping season is not present. Alternatively, some seed inputs from new sources, such as by dung-burning, can be suggested. Animals would have grazed a wider range of environments in all seasons and thereby introduced additional seasons of weedy plant seeds via their dung. Further research should be targeted towards distinguishing these alternative hypotheses.

The height at which crops were harvested in the past can be inferred from looking at the present day growing heights of arable weeds (refer to section 6.4.4.2). The weed height data from Cyprus is suggestive of low harvesting heights (~ 40 cm maximum height) of crops since there are a greater proportion of weeds with low growing heights in contrast to the medium and high growing weeds. Also noted, is an increase over time, from the Aceramic Neolithic to the late Bronze Age, in weeds that grow to low heights, in particular weeds from 11-50 cm. Low and medium-height weeds are likely to be representative of harvesting cereals by cutting (e.g. with sickles) low on the culm as opposed to harvesting of the ears only (Kreuz *et al*. 2005, 249; see also Hillman 1981). It is probable that the crops were harvested low as to maximise the yield of straw; which could have been utilized for many purposes, including bedding, matting, or as animal food. The likely continued use of straw as animal feed further supports the integration of livestock and crop-based agriculture that was established in the Cypro-PPNB.

As stated above, there appears to be a correlation between a decrease in the hunting of fallow deer and agricultural intensification (Murray 1998); specifically by diversification through the adoption of new crops, e.g., free-threshing wheat. The continued hunting of fallow deer in Cyprus has been viewed as 'de-intensification' of agriculture in the Ceramic Neolithic and Chalcolithic. This is a light of the fact that hunting of fallow deer constitutes over 70% of the faunal assemblages in these phases. (Clarke *et al.* 2007). Clarke *et al.* (2007, 62) suggest that the evolutionary pressures, including demographic pressure, that drove agricultural intensification on the mainland were absent on Cyprus and as a result, de-intensification occurred. There appears to be no evidence for de-intensification of agricultural practices of cereal and pulse crops during the Ceramic Neolithic and Chalcolithic of Cyprus. In opposition there is evidence for agricultural intensification (pre- and post-harvest), extensification, and varietal diversification (crop choice). However, the high frequencies of glume wheat until the late Bronze Age likely correspond with the lack of demographic pressure and the delayed increase of social complexity on the island.

The archaeobotanical data from the Cypriot Aceramic Neolithic to the late Bronze Age provides evidence for varietal diversification in the crop assemblage, with new crop introductions over time. Although new crops were introduced, the Cypriot prehistoric preference for glume wheats and hulled barley is noted. This could be a result of many factors, including soil fertility, low population density, storage technologies, or cultural choice. The preference for glume wheat may relate to soil fertility with evidence from the weed data suggestive of agriculture on nitrogen poor soils. As mentioned above, it has been proposed that glume wheats grow well in un-irrigated fields and are resistant to drought and poor soils. Free-threshing wheat, on the other hand, grows better on irrigated soils that are more fertile and nitrogenous. Although soil fertility may have contributed to the choice of glume wheat over free-threshing wheat until the late Bronze Age, the choice is more likely a result of low population density, limited storage capabilities, and the level of social complexity. With regards to storage, glume wheat and hulled barley are better suited for post-harvest storage in pits. Glume wheat can be stored long-term when the grains are stored within the glumes, which protects the grain from spoilage and destruction/consumption by pests (Hillman 1981, 81). The increased rainfall in Cyprus during the winter months would have posed problems with grain storage, particularly since pit storage would have been vulnerable to high levels of moisture and as a result the grains would be more susceptible to spoilage (Hillman 1981, 138). The earliest evidence in Cyprus for bulk storage (e.g. evidence from pottery) is during the Chalcolithic, which corresponds with the increase in the frequency of free-threshing wheat[9]. The increase could also be a result of low population levels and the relationship between low population density, social complexity, and the mobilization and distribution of labour. The degree of labour mobilization between the single nuclear family, extended family, and large-scale mobilization are evident in the archaeobotanical record with evidence from both storage practices and the timing of late processing of stored crops. In Cyprus there is little evidence for intensification of labour and the control of surplus production prior to the Late Chalcolithic (Peltenburg 1993). Specifically evidence of intensification of labour and surplus control comes from archaeological evidence of increased potential volumes in centralized storage containers (e.g. evidence from pottery) (Peltenburg *et al.*. 1998). Further, pit storage of glume wheats in the glumes may be expected for smaller scale/household level organization, whereas above ground storage in built granaries or large pots will often be associated with larger architectural features and are more typical of complex societies. Thus, the proportions of glume wheat versus free-threshing wheat over time, corresponds to the archaeological evidence in Cyprus for population increase, an increase in storage capabilities, changes in the distribution of labour, increased social complexity, and the beginnings of change in food preparation and consumption technologies.

[9] However, this is with the exception of the limited botanical data from the early and middle Bronze Age

One of the aims of this thesis was to explore the evidence for the Near Eastern food cultural trajectory in Cyprus. This food tradition comprises grinding, roasting, and baking. Archaeological evidence for these activities includes ground stone tools used for grinding grain to flour, cooking pots for boiling, and hearths and ovens for baking, and consumption technologies that include pottery for the purpose of serving food and liquids. The earliest evidence on the mainland for this tradition of grinding cereals grains into flour comes from the Epipalaeolithic (Piperno et al. 2004; Weiss *et al.* 2008). Since there is no evidence of pottery or ovens in the Near East at this time, it is suggested that the flour was made into bread or seed cakes by baking in open hearths, as 'ash-baked' bread (Haaland 2006). The first evidence in this region of ovens, which were stoned-filled, cylindrical pits, comes from the PPNA with evidence for an increase in these archaeological features from about 7000 BC (Cauvin 2000; Fuller and Rowlands 2011; Rowlands and Fuller 2010; also see Maisels 1990). In Cyprus there is evidence for grinding grain and likely other plants with high oil contents and pigments from the Cypro-PPNA and Cypro-PPNB from the presence of ground stone artefacts associated with grinding. Although there is evidence for circular bread ovens on the mainland during the middle PPNB (Akkermans and Schwartz 2003) there is no evidence of ovens in Cyprus until the early and middle Bronze Age (Webb 2001). Haaland (2006) noted a correlation between the appearance of ovens to changes in domestic architecture and storage facilities, with a change from circular structures to rectangular buildings and an increase in storage capabilities, which is also the case for Cyprus. The appearance of ovens in the Cypriot early and middle Bronze Age corresponds with the first appearance of rectangular buildings on the island.

Ceramic evidence also marks changes in food storage, preparation and consumption traditions. Cyprus parallels the mainland in that the first appearance of pottery is associated with food storage and consumption technologies, such as serving, and drinking, as opposed to preparation technologies, i.e. boiling (see Atalay and Hastorf 2006; Haaland 2006, 2007). The earliest evidence of pottery in Cyprus comes from the Ceramic Neolithic and the vessel types include hemispherical bowls, ovoid jugs, bottles, and hole-mouth jars (Clarke 2001; Peltenburg 1982). In the Cypriot Chalcolithic there is evidence for new pottery types associated with serving, including jars, goblets, bottles and anthropomorphic and zoomorphic vessels (Peltenburg et al. 2006). It is not until the Philia phase that there is evidence for new forms of cooking technology, including vessels suitable for containing boiled liquids. Also at this time there is evidence of new serving containers, including small bowls, cutaway-spouted jugs, juglets, small jars, amphorae, and flasks. It is not until the early and middle Bronze Age that there is evidence for new modes of cooking, including cooking in pots and baking in pans and ovens, i.e. tannurs (Webb 2001).

It has been suggested that Cyprus deviated from the mainland cultural trajectory with regards to architecture and technological innovations during the Cypro-PPNB. The data on food consumption technologies supports this suggestion; though, it appears that the island did not deviate from the cultural trajectory of food preparation and consumption technology but rather followed the same cultural tradition but with a protracted adoption. Additionally, the archaeological evidence supports a delay in cultural developments, specifically in the adoption of pottery, rectangular architecture, storage facilities, and a slow transition away from deer hunting. Cyprus adopted mainland technologies and cultural traditions at a different pace and it appears that the timing of Cypriot developments correlates with demographic pressure, increasing social complexity, and change in the level and dynamics of mainland interaction.

7.5 External Contact during the Chalcolithic and Bronze Age of Cyprus

In the Neolithic the level of interaction between Cyprus and the mainland is well-established. Specifically there was a staggered influx of farming communities from the mainland beginning in the early PPNB. The botanical evidence supports the archaeological data for interaction, with a divergence in mainland crop choice (e.g., limited evidence of free-threshing wheat on the island at this time). However, the dynamics of the interaction between the mainland and Cyprus during the Chalcolithic and Early and Middle Bronze Age differs. It was mentioned previously (section 2.3.6.2) that the Chalcolithic is when the island goes from relative isolation and independence to involvement in the broader Mediterranean interaction sphere (Peltenburg *et al.* 1985). The archaeological data suggests increased involvement and contact with central Anatolia beginning in the Late Chalcolithic (Peltenburg et al. 1998; Steel 2004); with evidence of imported Anatolian obsidian on the island and evidence from Cypriot Chalcolithic pottery recovered from Anatolian Tarsus (Frankel and Webb 2006, 104). In addition to changes in agricultural practices (e.g., the plough and extensification) there is evidence of change in architecture, food preparation, dress, burial practices, and metallurgical technology (Peltenburg 1996), the latter of which played an important role in the increase in external contact and Anatolian migration in the Early Bronze Age. It is argued that groups in Cyprus advertised to Anatolia the island's potential economic resource (i.e. copper), which subsequently led to the increased external interest in the island (Manning 1993, 35; Peltenburg 1996, 27). The botanical data supports the archaeological evidence that suggests an increase in contact between Anatolia and Cyprus during the Chalcolithic and early and middle Bronze Age, with close parallels between the taxonomic compositions of both regions. External interest in the Cypriot copper resources beginning in the Chalcolithic had a huge impact on the island's population and subsequent social development, both of which affected the level of agricultural production (i.e., intensification and extensification), the unique Cypriot hunting culture, crop choice, food preparation and consumption technology and the ensuing development of the Cypriot Late Bronze Age economy that involved the development of "cash-crops" (e.g., olive oil and wine).

7.6 Conclusions

This research is the first to assemble the archaeobotanical data from sites located in Cyprus and dated to the Aceramic Neolithic to the Late Bronze Age and to compare the Cypriot material with data from surrounding regions. The research presented in this thesis has illustrated the value of collating archaeobotanical datasets in regional studies. Further, the results contribute to Cypriot archaeological discourse, specifically with regards to the island's prehistoric economy and its level of interaction with the broader Near Eastern interaction sphere over time. The results of multivariate analysis revealed regional patterns in the taxonomic composition of plant material from Cyprus and the surrounding regions and that these patterns change from the Neolithic to the Bronze Age. In the Neolithic, Cyprus was regionally distinct from the surrounding regions but showed closer parallels with western Syria. In opposition, in the Chalcolithic and Early and Middle Bronze Age, Cyprus shows more similarities with Anatolia, which supports the archaeological evidence that is suggestive of increasing Anatolian contact at this time. A relationship between increasing contact with Anatolia, the Cypriot copper resources, agricultural intensification, extensification, and diversification (i.e. crop choice) was established in this thesis. Intensification of agricultural practices on the island is the result of increasing external contact and the subsequent population increase and change in social structures from the Chalcolithic onwards.

7.7 Suggestions for Future Research

This research has emphasized a number of areas that would benefit from further analyses. As stated in the introduction, in the last thirty years what is known of the prehistory of Cyprus has changed greatly. The prehistory of the island is constantly being re-written as data from nearly every site appears to change previously held ideas with regards to the island's first inhabitants, the dynamics of the spread of farming to the island, and the context of social developments (Broodbank pers comm. April 2012).

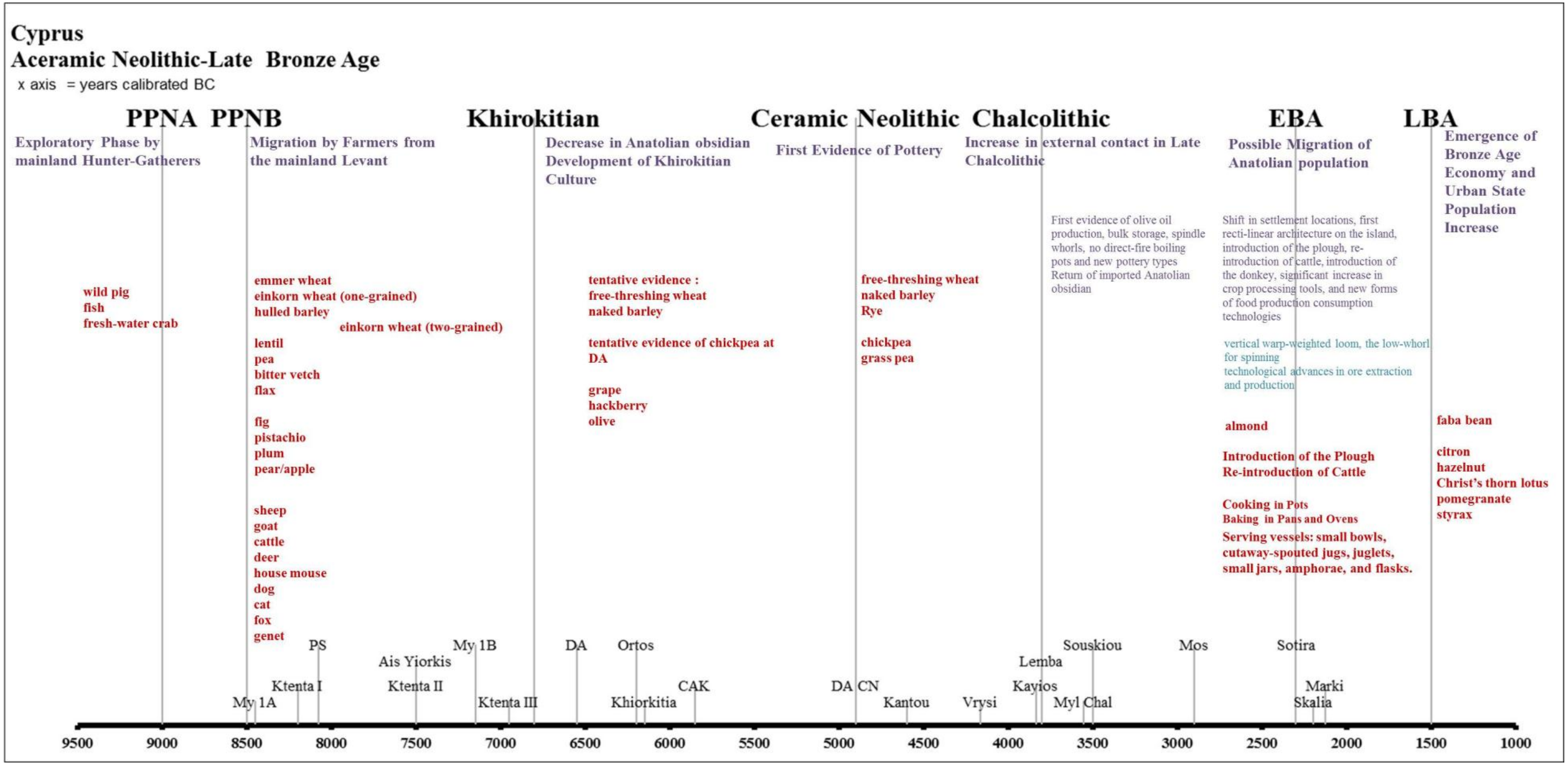
It is early days for archaeobotanical analyses on the island and as a result additional botanical results will no doubt contribute to the issues addressed in this thesis. As discussed in Chapter 6, the botanical samples from Cypriot archaeological sites have been relatively poor in charred remains. Future flotation efforts on the island would benefit from larger sample sizes and more effective sampling strategies. There are two cultural phases where very little botanical data have been recovered, the Ceramic Neolithic and Bronze Age, both of which would contribute to Cypriot archaeological discourse. In particular, more botanical data is needed from the early and middle Bronze Age to better compare to the surrounding regions, including Egypt and the Aegean. Future research would also benefit from flotation efforts on Late Bronze Age sites, as very little has been done previously.

This thesis revealed some interesting patterns with regards to the arable weed data. However, the analyses of the weed assemblages were on a more general level and therefore a more in-depth analysis of the weed data are desirable. In particular, the application of Functional Interpretation of Botanical Surveys (FIBS) data would no doubt contribute to the regional analyses presented here. Alhough it has often not been possible to identify weed seeds to species level some further efforts at refining specific identification criteria for weeds may prove useful. With regards to the weed evidence, species level identification may further clarify the seasonal patterns represented by the weed flora. This is important as two hypotheses have been suggested that could account for the apparent increase in summer flowering weeds. The first is the addition of later harvested crops, including spring-sown crops. The second hypotheses is that the additional weed seeds were a result of animal dung burning as animals would graze beyond the main spring harvest season. Establishing whether irrigated summer crops contributed to Bronze Age harvests on Cyprus could be tested through the application of stable carbon isotopes on charred archaeological grains, a fairly new methodology (Ferrio *et al*. 2005; Riehl *et al*. 2008). Other outcomes of stable isotope analysis could be evidence for degrees of manuring and/or soil exhaustion (Fraser *et al.* 2011; Kanstrup *et al.* 2012). Further, the presence of dung fuel could also be assessed by additional methodologies such as the chemical analysis and phytolith assemblages from hearth fills or wood charcoal concentrations, as per the new methodology of Lancelotti and Madella (2012).

A more detailed examination of the Cypriot food culture is also needed. In particular, a more complete exploration of changes in food preparation and consumption technologies during the Late Chalcolithic and Bronze Age could provide better insight into the interaction between Cyprus and the surrounding regions. Future applications of residue analysis in ceramic vessels or studies of micro-remains (e.g., starch and phytoliths) from grinding tools could provide evidence for a more direct association between specific artefacts and the preparation of cereals or other crops.

While this thesis has highlighted multiple areas for future study, it demonstrates the value of regional studies of large archaeobotanical datasets for contributions to a better understanding of archaeological cultural traditions in terms of connections over time and space in food culture and agricultural practices.

Figure 7.1 Timeline of notable Cypriot cultural developments and summary of crop and animal introductions to island from the Aceramic Neolithic to the Late Bronze Age



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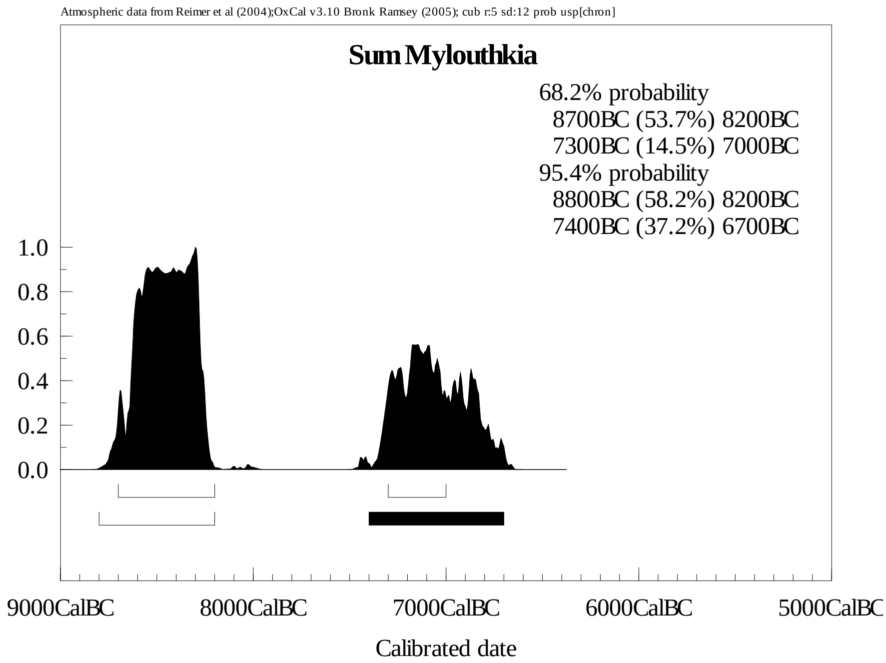
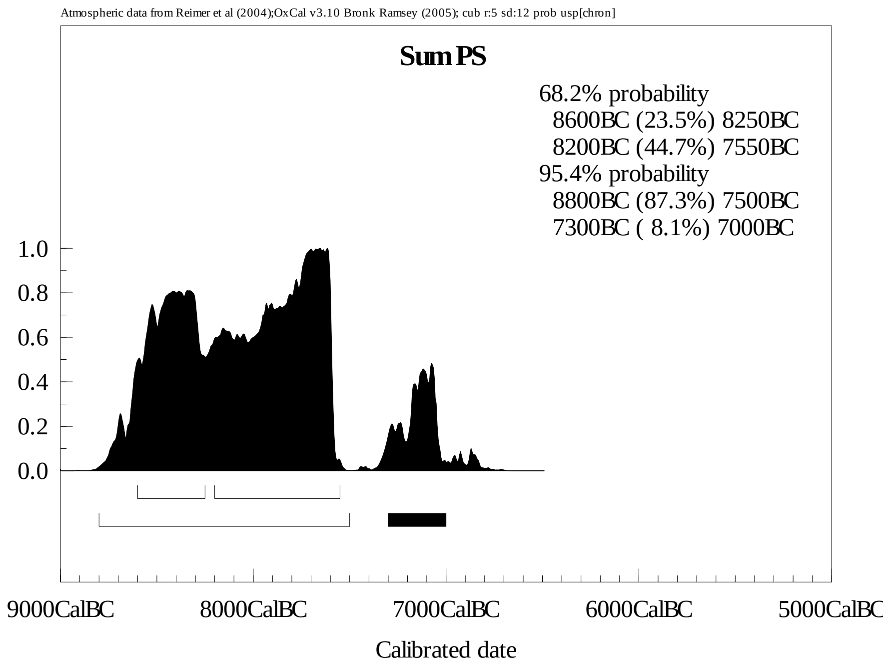
Appendix 1

Calibrated Radiocarbon Dates from Cypriot Sites

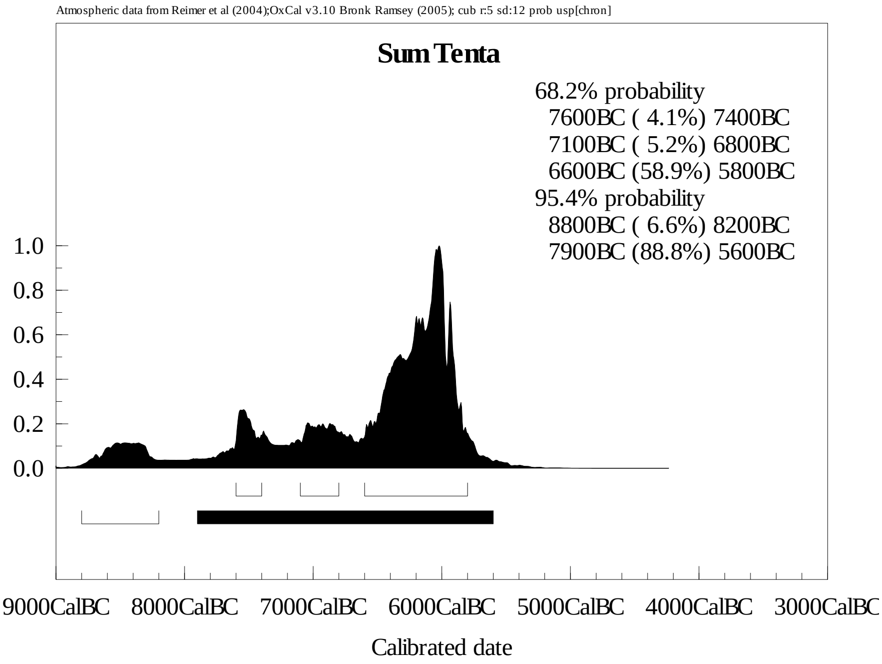
Calibrated radiocarbon dates Kissonerga-Mylouthkia. Calibrated in OxCal 3.10, using the IntCal09 calibration curve.



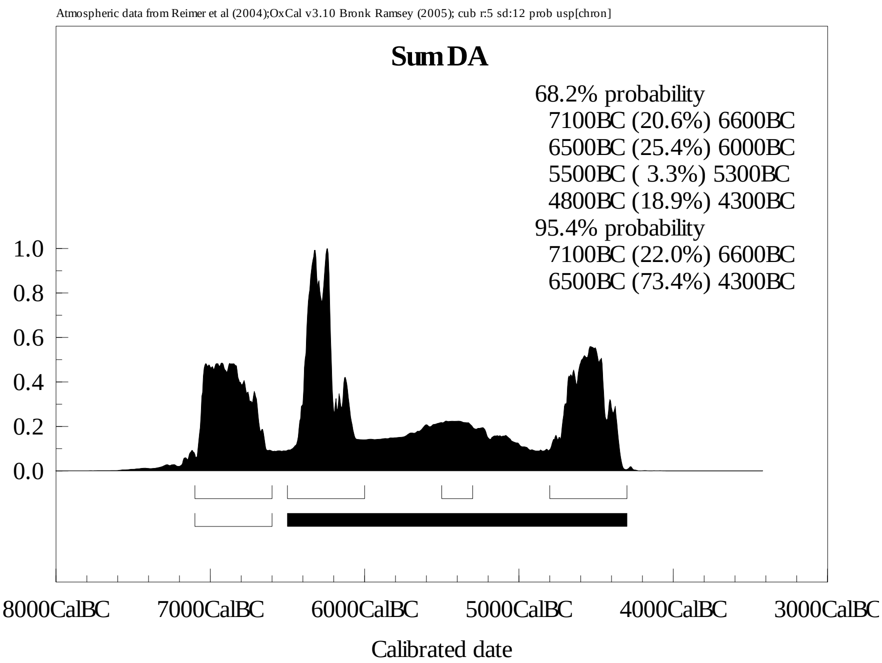
Calibrated radiocarbon dates Shillourokambos. Calibrated in OxCal 3.10, using the IntCal09 calibration curve.



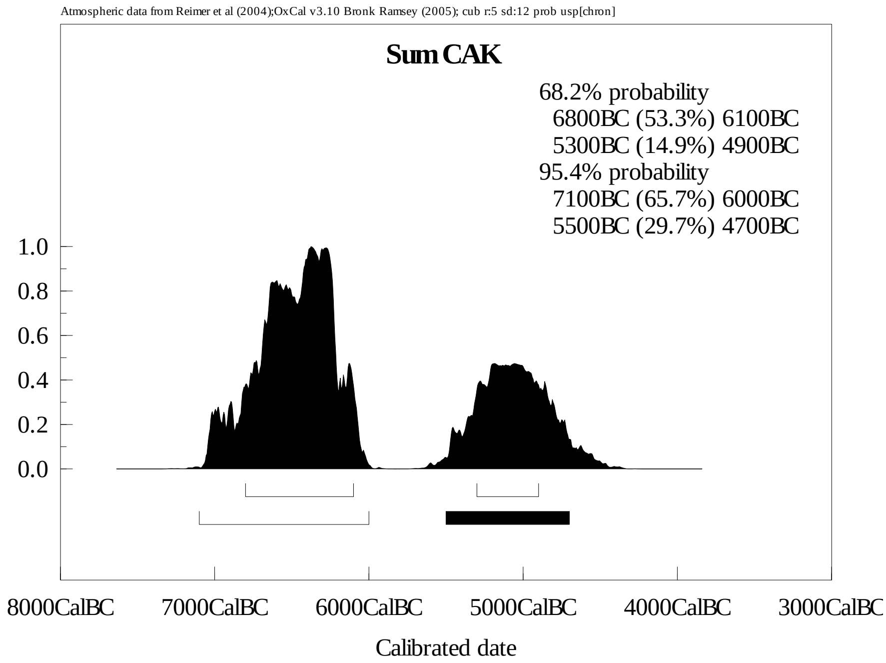
Calibrated radiocarbon dates Tenta. Calibrated in OxCal 3.10, using the IntCal09 calibration curve. (Todd 2004 in Swiny ed)



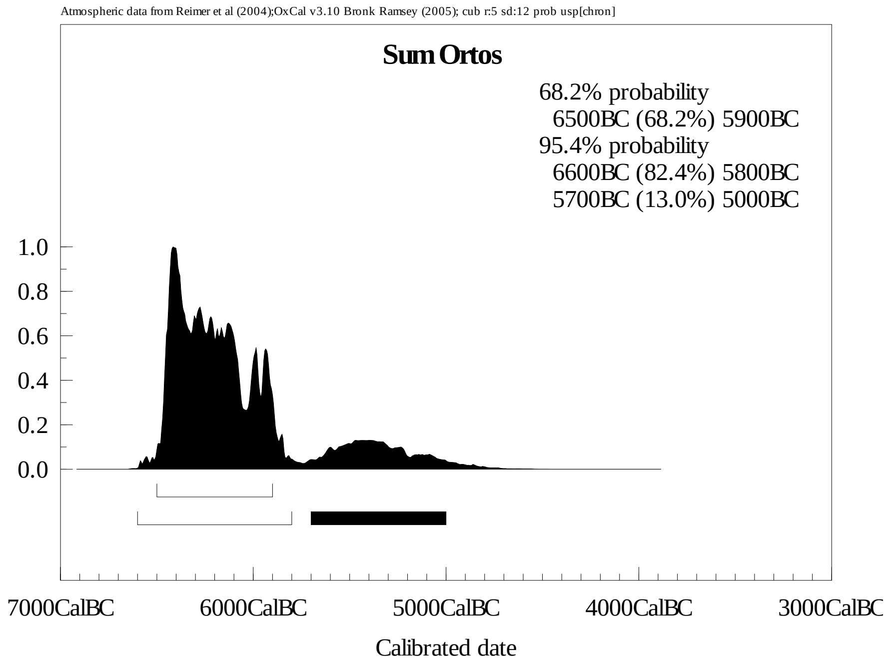
Calibrated radiocarbon dates Dhali Agridhi. Calibrated in OxCal 3.10, using the IntCal09 calibration curve. (Clarke 2007, Steel 2004)



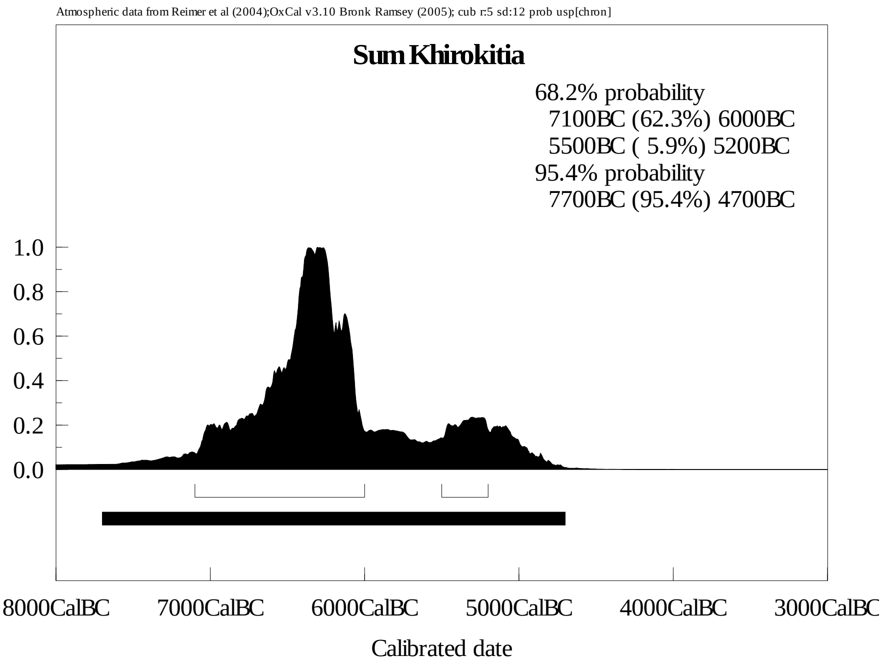
Calibrated radiocarbon dates Cape Andreas Kastros. Calibrated in OxCal 3.10, using the IntCal09 calibration curve. (Le Brun 1981)



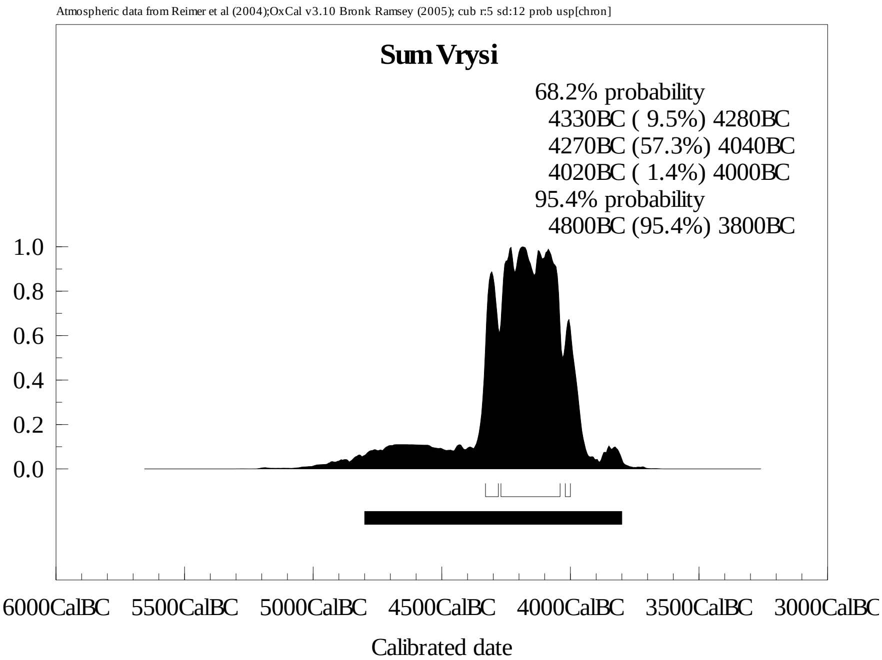
Calibrated radiocarbon dates Ortos. Calibrated in OxCal 3.10, using the IntCal09 calibration curve. (Simmons 1994)



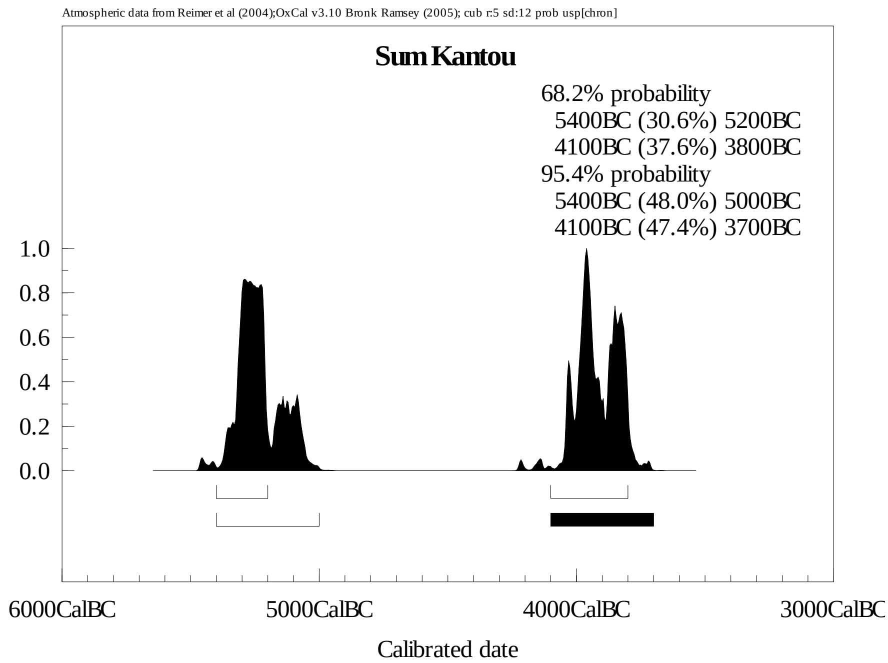
Calibrated radiocarbon dates Khirokitia. Calibrated in OxCal 3.10, using the IntCal09 calibration curve.



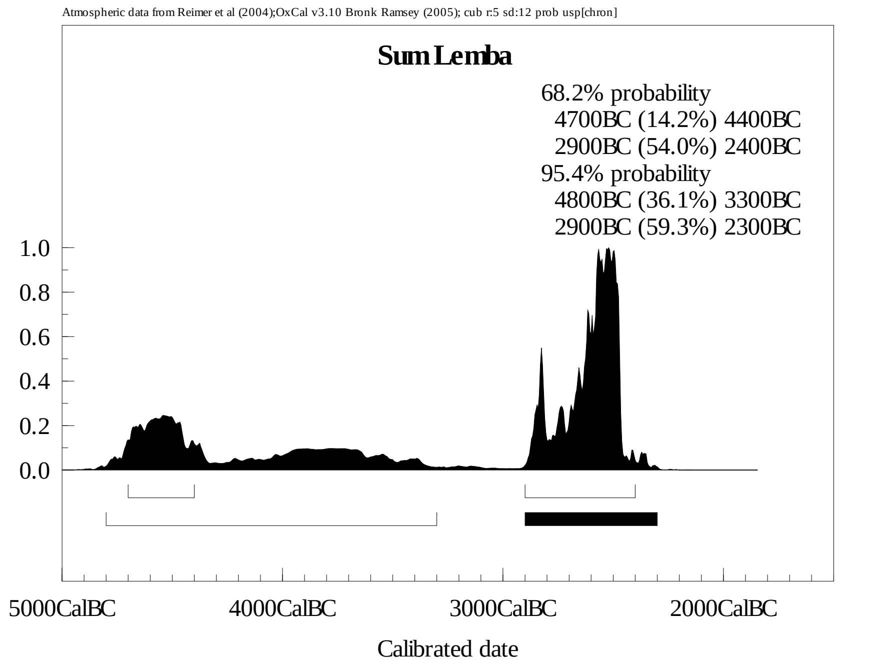
Calibrated radiocarbon dates Ayios Epiktitios Vrysi. Calibrated in OxCal 3.10, using the IntCal09 calibration curve.



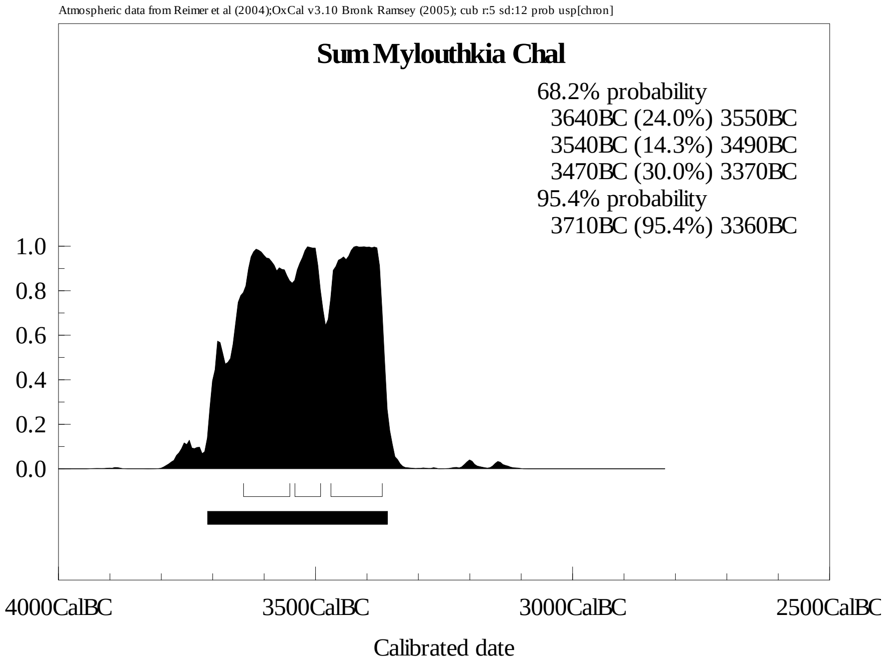
Calibrated radiocarbon dates Kantou Kouphovounos. Calibrated in OxCal 3.10, using the IntCal09 calibration curve (Mantzourani 2004).



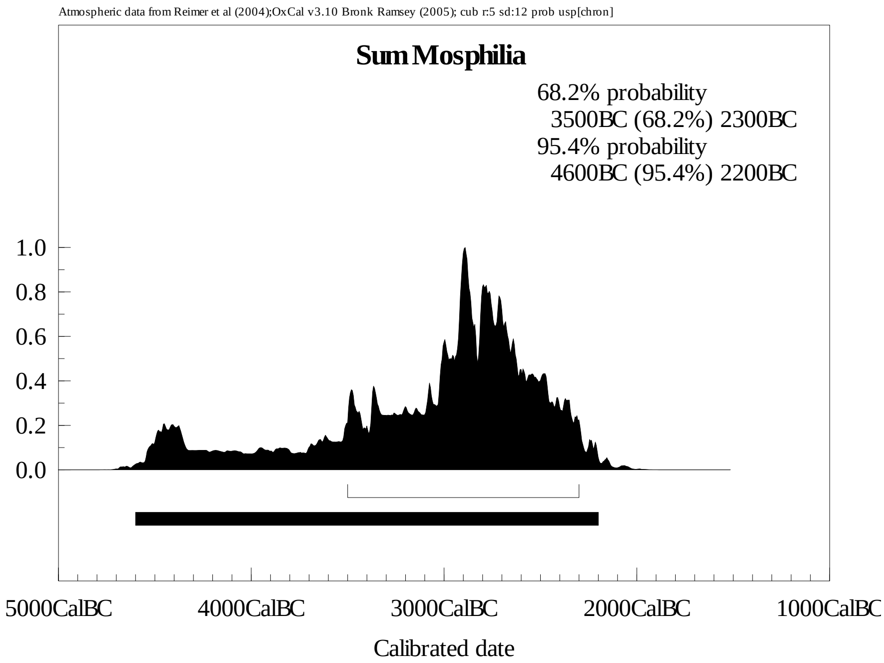
Calibrated radiocarbon dates Lemba Lakkous. Calibrated in OxCal 3.10, using the IntCal09 calibration curve



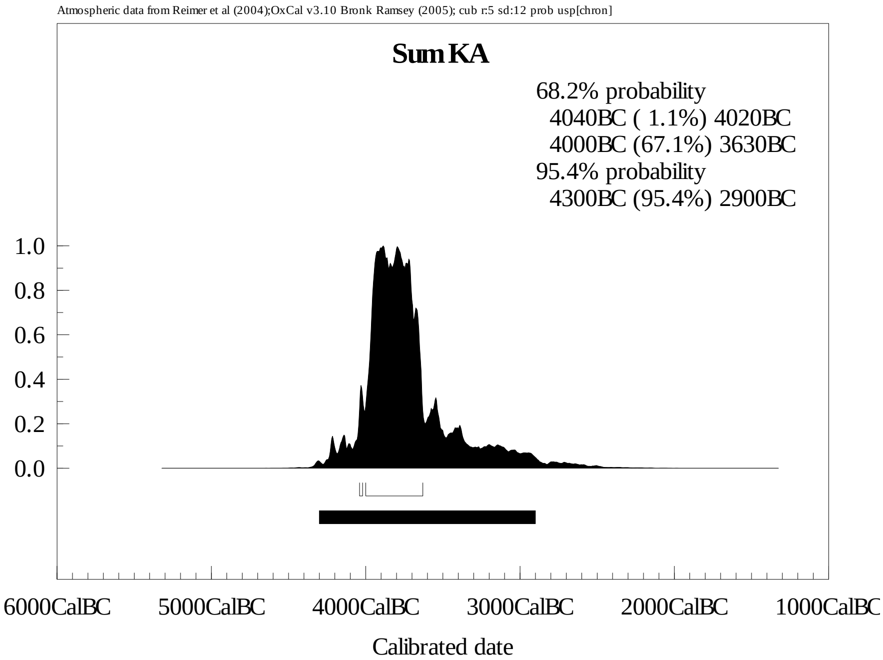
Calibrated radiocarbon dates for Chalcolithic Kissonerga Mylouthkia. Calibrated in OxCal 3.10, using the IntCal09 calibration curve



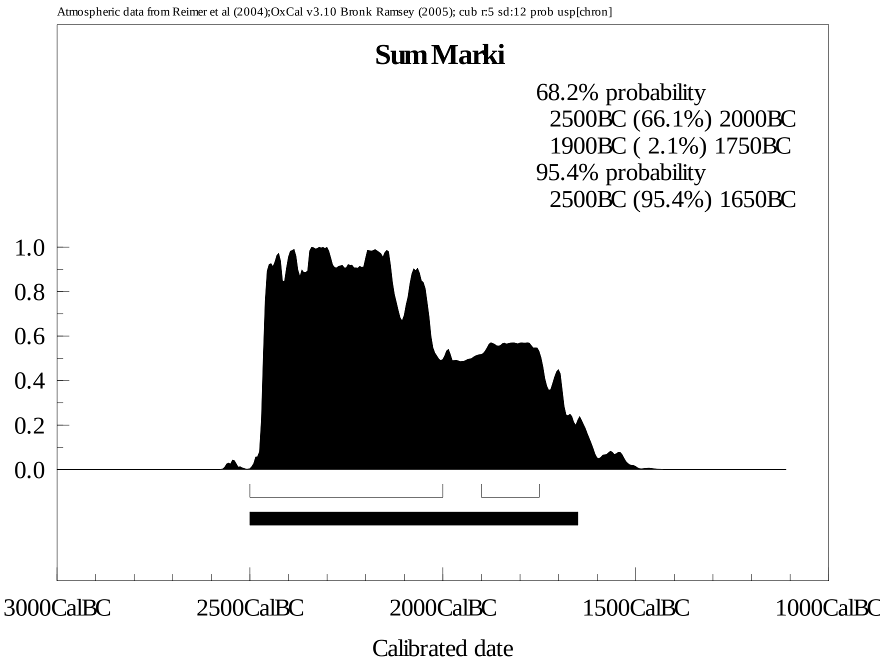
Calibrated radiocarbon dates for Chalcolithic Kissonerga Mosphilia Calibrated in OxCal 3.10, using the IntCal09 calibration curve



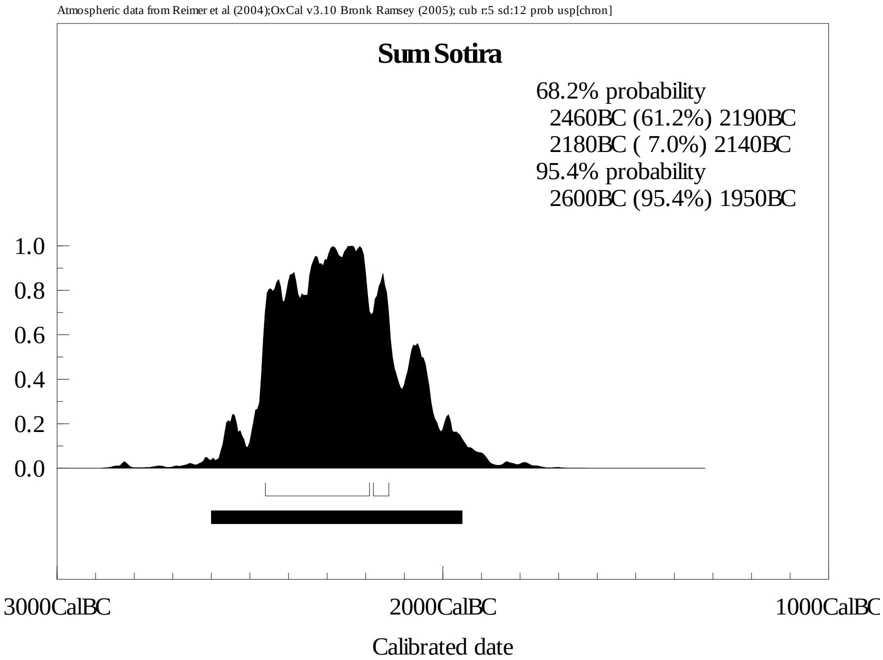
Calibrated radiocarbon dates for Chalcolithic Kalavasos Ayios. Calibrated in OxCal 3.10, using the IntCal09 calibration curve



Calibrated radiocarbon dates for Chalcolithic Marki Alonia. Calibrated in OxCal 3.10, using the IntCal09 calibration curve



Calibrated radiocarbon dates for Chalcolithic Sotira Kaminoudhia. Calibrated in OxCal 3.10, using the IntCal09 calibration curve



Appendix 2

Flowering Times and Growing Heights of Arable Weeds in Cyprus

Appendix 2 Table that shows the flowering times and growing heights of genera present in samples dated to the Aceramic Neolithic, Ceramic Neolithic, Chalcolthic, and Bronze Age of Cyprus; ‘n’ denotes number of species. Data compiled from Meikle (1977, 1985).

		Flowering Times												Growing Height											
Genus	**n**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**0-5**	**5-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**>100**
Adonis	4		2	4	4	3									1	2	2	1	1	1					
Aegilops	6			2	6	5	1	1						5	5	4	4	3	1						
Ajuga	3	1	1	2	3	3	2	2	1						2	2	1								
Alkanna	1		1	1	1											1	1								
Amaranthus	5				1	1	3	5	5	4	4	2	1			2	3	3	3	1	1	1	1	0	1
Anagallis	1		3	3	3	3	1	1	1	1	1			1	1	1	1								
Anchusa	5		2	5	5	5	1								3	5	5	4	4	2	2	2	2	2	2
Anthemis	9		3	7	10	9	5	3	1	1				2	6	8	7	4	2						
Arctium	1							1	1	1	1									1	1	1	1	1	1
Arrhenatherum	1					1	1							1	1	1	1	1	1	1	1	1	1	1	1
Asphodelus	3	1	1	3	3	1	1								1	1	1	2	2	1	1				
Astragulus	12		4	10	11	4								3	5	6	5	3	3	3					
Avena	9		1	6	8	6	3	1						7	7	7	7	7	7	6	4	4	4	4	4
Beta	1		1	1	1	1									1	1	1	1	1	1	1	1	1	1	1
Bifora	1		1	1	1	1										1	1								
Brassica	3		1	3	3	3	1							3	4	7	5	1	1	1					
Bromus	17	1	2	9	15	11	7	2						8	8	8	6	6	5	5	3	3	2	1	1
Bryonia	1		1	1	1																				
Buglossoides	2+	2	2	1	1	1	1								3	3	3								
Bupleurum	10		1	2	7	8	5	3	1	1				2	7	8	7	2	2						
Calendula	1			1	1	1											1								
Carex	11			3	6	6	4	2	1	1						1	1	3	2	3	3	2			

		Flowering Times												Growing Height											
Genus	**n**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**0-5**	**5-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**>100**
Carthamus	4				1	1	2	4	3	2					1	4	4	4	4	3	3	3	2	2	2
Centaurea	7				5	5	6	5	2						2	6	6	5	4	4	1	1	1	1	1
Chenopodium	6			1	1	1	5	5	4	4	1				2	3	5	3	3	3	2	2	2	2	2
Chrozophora	1					1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	1
Chrysanthemum	2	1	2	2	2	2	1	1	1	1	1	1	1		1	2	2	2	2	1	1	1	1	1	1
Cleome	2						2	2	2	2					1	1	1	1	1	1	1	1	1		
Coronilla	5		3	5	5	2									2	2	1	1	2	1	1	1	1	1	1
Crucianella	4				2	4	4	3							3	4	3	2	1						
Cyperus	7		2	2	2	4	4	5	5	5	4	2	1		5	6	7	5	4	2	1	1	1	1	1
Echinaria	1				1	1								1	1	1									
Echium	5		1	3	4	5	4	1							1	3	2	3	2	2	2	1	1	1	1
Eleocharis	1			1	1	1	1										1	1	1	1					
Emex	1	1	1	1	1										1	1	1	1	1						
Eragrostis	1						1	1	1	1	1				1	1									
Euphorbia	25	1	8	11	12	13	15	10	9	10	4	1			13	12	12	10	4	3	2	1	2	2	2
Fumaria	9	3	5	8	9	8	3	1																	
Galium	14		3	8	8	11	11	4	2	1				1	8	11	7	5	3	3	3	3	3	3	3
Genista	1			1	1	1	1	1																	1
Geranium	8		5	8	8	7	1	1																	
Gypsophila	1				1	1	1	1	1																
Heliotropium	4				2	4	4	4	4	4	4	4			2	3	3	3	1						
Helianthermum	7		3	5	6	6	3	1																	
Hordeum	8			5	7	7	4							7	8	8	7	6	4	3	3	2	1		
Hyoscyamus	2	1	2	2	2	2	2	2	1	1				1	1	1	2	2	2	2	1	1	1	1	1
Limonium	7			1	3	4	4	4	3	2	2			1	5	4	4	3	1	1					

		Flowering Times												Growing Height											
Genus	**n**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**0-5**	**5-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**>100**
Lolium	5			3	4	4	3							4	4	4	3	3	2	2					
Lupinus	2			1	2	2									2	2	2	1	1						
Malcomia	3		3	3	3	3	1																		
Malva	6		2	4	5	5	4	2	2	2				0	3	3	3	3	2	2	1	1	1	1	1
Medicago	20	1	11	17	18	16	6	4	2	1				1	12	18	17	12	6	1	1	1			
Melilotus	4		1	3	3	2	3	1	1						1	4	4	1	1						
Muscari	4	1	2	3	1	1					1	1	2												
Neslia	2		2	2	2	2	2									1	1	1	1						
Onobrychis	4		3	4	4	4									2	3	3								
Onopordum	2				1	1	2	2	1										1	1	1	1	1	1	2
Ornithogalum	5			4	5	2	1																		
Oxalis	2	1	1	1	2	2	1	1	1	1		1	1		2	2	1								
Papaver	7		3	4	8	8	6								3	5	4	4	2	1					
Phalaris	5		1	2	2	2	3	1	1	1					2	3	3	2	2	2	1	1	1	1	1
Picris	3				1	2	2	2						1	1	4	4	3	3	2	2	2			
Pimpinella	4				3	4	3	2	1						2	3	3	3	3	3	3	1	1	1	
Plantago	14		7	15	16	16	7	5	5	5	4				2	2	2	1	1						
Polygonum	7			1	2	4	6	6	6	4	2				2	2	2	3	6	5	4	3	3	3	3
Ranunculus	19	2	6	11	11	7	1					1	1												
Raphanus	2		2	2	2	2																			
Rumex	6			2	4	5	4	3	1	1					2	4	4	3	4	4	4	2	2	2	2
Salsola	3					2	2	2	2	2	1	1			1	3	2	2	2	2					
Schoenus	1			1	1	1	1	1								1	1	1	1	1	1	1			
Scirpus	1				1	1	1	1	1	1							1	1	1	1	1	1	1	1	1
Scorpiurus	1		1	1	1	1	1	1																	

		Flowering Times												Growing Height											
Genus	**n**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**0-5**	**5-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**>100**
Senecio	4	3	4	4	3	3	2	2	2	2	2	2	2	2	3	3	4	2	1	1					
Setaria	4						3	4	4	4	4			2	3	3	3	3	3	1	1	1	1	1	
Sherardia	1		1	1	1	1								1	1	1									
Sisybrium	4		2	2	4	4	2	2	1						2	4	4	4	4	3	2	2	2	1	1
Solanum	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	1	1	1	1	1	
Spergularia	3		3	3	3	3	3	1	1	1					3	3	1								
Stipa	5			2	3	4	2	1	1						4	4	4	4	4	3	1	1	1	1	
Suaeda	3	1	1	1	1	1			2	2	3	1	1	1	1	3	3	3	2	1	1	1			
Teucrium	6			1	2	4	6	5	1	1				1	4	4	3	2	2	2	1	1			1
Thymelaea	3	1	2	2	3	2	1									1	2	2	3	3	2	2	2	2	2
Trifolium	31	1	5	21	26	20	14	6	2	1	1			3	21	24	17	2	1	1	1				
Trigonella	9		2	9	9	7	3							4	7	7	2	1							
Valerianella	10		1	6	6	5								1	1	1	1								
Veronica	8	3	4	6	8	7	7	4	3	2	1	1	4	5	5	5	1								

Appendix 3

Site Names, Locations, Periods, and Phase Codes

Country/location	site_name	phase_code	period
Cyprus	Ayios Epiktitos Vrysi	AEVrysi	Neolithic
Cyprus	Krittou Marottou 'Ais Yiorkis	Ayiorkis	AN
Cyprus	Dhali Agridhi	DhAgCN	PN
Cyprus	Kalavasos Ayious	KalAys	C
Cyprus	Khirokitia Vounoi	KhTh	AN
Cyprus	Khirokitia Vounoi	KhV1	AN
Cyprus	Khirokitia Vounoi	KhV2	AN
Cyprus	Khirokitia Vounoi	KhV2/3	AN
Cyprus	Khirokitia Vounoi	KhV3a	AN
Cyprus	Khirokitia Vounoi	KhV3b	AN
Cyprus	Khirokitia Vounoi	KhV4	AN
Cyprus	Khirokitia Vounoi	KhVC-F	AN
Cyprus	Kantou Kouphovounos	Kkouph	Late Neolithic
Cyprus	Kissonerga Mosphilia	KMos2	EC
Cyprus	Kissonerga Mosphilia	KMos3A	MC
Cyprus	Kissonerga Mosphilia	KMos3B	MC
Cyprus	Kissonerga Mosphilia	KMos4	LC
Cyprus	Kissonerga Mylouthkia	KMy1A	AN
Cyprus	Kissonerga Mylouthkia	KMy1B	AN
Cyprus	Kissonerga Mylouthkia	KMyCh	C
Cyprus	Kholetria Ortos	KOrt2B	AN
Cyprus	Kholetria Ortos	KOrt3	AN
Cyprus	Kholetria Ortos	KOrt3A	AN
Cyprus	Kholetria Ortos	KOrt3B	AN
Cyprus	Kholetria Ortos	KOrt4A	AN
Cyprus	Kholetria Ortos	KOrt4B	AN
Cyprus	Kholetria Ortos	KOrt4C	AN
Cyprus	Kalavasos Panayia Church Cemetery	KPCMC	Middle Bronze Age
Cyprus	Kalavasos Tenta	KTen1/2	AN
Cyprus	Kalavasos Tenta	KTen2	AN
Cyprus	Kalavasos Tenta	KTen2/3	AN
Cyprus	Kalavasos Tenta	KTen2L	AN
Cyprus	Kalavasos Tenta	KTen3	AN
Cyprus	Kalavasos Tenta	KTen3/4	AN
Cyprus	Kalavasos Tenta	KTen3L	AN
Cyprus	Kalavasos Tenta	KTen4	AN
Cyprus	Kalavasos Tenta	KTen4/5	AN
Cyprus	Kalavasos Tenta	KTen4E	AN
Cyprus	Kalavasos Tenta	KTenCNC	CN_EC
Cyprus	Marki Alonia	MkAlon	EBA
Cyprus	Prastio Mesorotsos	Pmes	AN
Cyprus	Prastio Agios Savvas tis Karonis Monastery	PrASav	Middle Chalcolithic
Cyprus	Souskiou Laona	Slaona	EC
Cyprus	Sotira Kaminoudhia	SotKam	EBA
Egypt	Hierakonpolis	HP	C_PD
Egypt	Kom el-Hisn	KEH	EBA_OK
Egypt	Maadi	MD-30	EBA_PD
Egypt	Maadi	MD-70	EBA_PD
Egypt	Nagada-Khattara	NK-KH 3	C
Egypt	Nagada-Khattara	NK-ST	C

Country/location	site_name	phase_code	period
Egypt	Tell el-Fara'in	TEF-I	C
Egypt	Tell el-Fara'in	TEF-II	C
Egypt	Tell el-Fara'in	TEF-III	EBA_Proto_D
Egypt	Tell el-Fara'in	TEF-IV	EBA_Proto_D
Egypt	Tell el-Iswid	TEI_ED	EBA_ED
Egypt	Tell el-Iswid	TEI_PD	C_PD
Egypt	Tell Ibrahim Awad	TIA-B	EBA_early
Egypt	Tell Ibrahim Awad	TIA-ED	EBA_ED
Egypt	Tell Ibrahim Awad	TIA-PD	C_PD
Egypt	Umm el-Qaab	UEQ	C_PD
Israel	Arad	A_I	EBA_II
Israel	Arad	A_II	EBA_II
Israel	Arad	A_III	EBA_II
Israel	Arad	A_III-II	EBA_II
Israel	Arad	A_IV	EBA_IB
Israel	'Afula	AF_MB	MBA_II
Israel	Beth Shean	BS	EBA
Israel	City of David	CD_EBAI	EBA_I
Israel	City of David	CD_MBA	MBA
Israel	En Besor	EBES	EBA
Israel	Horvat Beter	HB	C
Israel	Hirbet el-Msas (Tel Masos)	HM_C	C
Israel	Kissufim Road	KR	C
Israel	Manahat	MT	MBA _IIB
Israel	Nahal Mishmar	NM-C	C
Israel	Nahal Qanah Cave	NQC_C	C
Israel	Numeira	NU	EBA_III
Israel	Sataf	SAT_C	C
Israel	Sataf	SAT_EB	EBA_I
Israel	Shiloh	SH_MB	MBA_III
Israel	Shiqmim	SQ_LV	EBA
Israel	Shiqmim	SQ_UV	MC
Israel	Tell Abu Matar	TAM	C
Israel	Tel Dalit	TD	EBA_II
Israel	Tell el Ifshar	TEIF_EBA	EBA
Israel	Tell Gezer	TGE	EBA
Israel	Tell Gerisa	TGER_MB	MBA
Israel	Tell Halif	THF_C	C
Israel	Tell Halif	THF_EBA	EBA
Israel	Tell Qashish	TQASH	EBA
Israel	Tell Qiri	TQI	BA
Israel	Tell Taannach	TT_EB	EBA
Israel	Tell Taannach	TT_MB	MBA
Israel	Tell Yoqneam	TY_MB	MBA
Israel - Northern	Yiftah'el	Y	middle PPNB
Jordan	Abu Hamid	AHA	LC
Jordan	Bab'edh Dhra	BDRA-C	EBA_I
Jordan	Bab'edh Dhra	BDRA-T	EBA_I
Jordan	Jawa	JAW	C
Jordan	Rukeis	RK	BA
Jordan	Tell el-Handaquq	TEH	EBA_I
Jordan	Tell Esh-Shuna	TES_C	EC
Jordan	Tell Esh-Shuna	TES_EB1E	EBA_I_early
Jordan	Tell Esh-Shuna	TES_EB1L	EBA_I_late

Country/location	site_name	phase_code	period
Jordan	Tell es-Sa'idiyeh	TESA	EBA
Jordan	Tuleilat Ghassul	TG	C
Jordan	Wadi Fidan	WF-E	C
Jordan - Eastern (Azraq Basin)	Azraq 31	Az31	late PPNB
Jordan - Eastern (Azraq Basin)	Wadi Jilat 13	WJ13	early Late Neolithic
Jordan - Eastern (Azraq Basin)	Wadi Jilat 6	WJ6	Epipalaeolithic
Jordan - Eastern (Azraq Basin)	Wadi Jilat 7	WJ7I	early PPNB
Jordan - Eastern (Black desert)	Dhuweila	DHI	late PPNB
Jordan - Eastern (Black desert)	Dhuweila	DHII	later Late Neolithic
Jordan - Southern	Basta	BA	late PPNB
Jordan - Southern	Beidha	BE	middle PPNB
Jordan - Southern	Wadi Fidan A	WFA	late PPNB
Jordan - Southern	Wadi Fidan C	WFC	final PPNB
Palestine	Jericho_SR	J-C	C
Palestine	Jericho_SR	J-EBA	EBA
Palestine	Jericho_SR	J-EBA_MBA	EBA
Palestine	Jericho_SR	J-MBA	MBA
Palestine	Lachish	LH_EB	EBA
Palestinian Territories	Jericho	JEII	middle PPNB
Palestinian Territories	Jericho	JEIII	PN
Syria	Tell Hadidi	HAD-MB	MBA
Syria	Tell Hammam et-Turkman	HET_C	LC
Syria	Tell Hammam et-Turkman	HET_EBA	EBA
Syria	Tell Hammam et-Turkman	HET_MBA	MBA
Syria	Hajji Ibrahim	HI	EBA
Syria	Kosak Shamali	KS	C
Syria	Tell al-Rawda	RAW	EBA
Syria	Tell Selenkahiye	SLK-CTA	EBA_IV
Syria	Tell Selenkahiye	SLK-NH	EBA_IV
Syria	Tell Selenkahiye	SLK-STA	EBA_IV
Syria	Tell Selenkahiye	SLK-TWR	EBA_IV
Syria	Tell es-Sweyhat	SWE_M	EBA
Syria	Tell es-Sweyhat	SWE_Z	EBA
Syria	Tell Atij	TA	EBA
Syria	Tell Afis	TAF-C	LC_late Ubaid
Syria	Tell Afis	TAF-EBA	EBA_IVB
Syria	Tell Afis	TAF-MBA	MBA_I
Syria	Tell Aqab	TAQ	EC_late Halaf
Syria	Tell al-Raqa'i	TAR-2	EBA
Syria	Tell al-Raqa'i	TAR-3	EBA
Syria	Tell al-Raqa'i	TAR-4	EBA
Syria	Tell al-Raqa'i	TAR-5_7	EBA
Syria	Tell Bderi	TB-ED_EA	EBA_ED_II
Syria	Tell Bderi	TB-ED_EAJ	EBA_ED_II
Syria	Tell Bderi	TB-EDIII	EBA_ED_II
Syria	Tell Bderi	TB-EDIIIJ	EBA_ED_II
Syria	Tell Brak	TBR-I	LC_EU
Syria	Tell Brak	TBR-II	LC_middle Uruk
Syria	Tell Brak	TBR-III	EBA_N_V
Syria	Tell Brak	TBR-IV	EBA_ED_I
Syria	Tell Brak	TBR-L	EBA_ED_III_late
Syria	Tell Brak	TBR-L/M	EBA_ED_III
Syria	Tell Brak	TBR-M	EBA_Akkad
Syria	Tell Brak	TBR-N	EBA_MBA_PA

Country/location	site_name	phase_code	period
Syria	Tell el'Abd	TEA	EBA
Syria	Tell Ilbol	TI	C
Syria	Tell Jerablus Tahtani	TJT	EBA_III
Syria	Tell Kerma	TKE	EBA
Syria	Tell Nebi Mend (Kadesh)	TNM_EBA	EBA
Syria	Tell Qaramel	TQA	BA
Syria	Tell Qara Quzaq	TQQ_II	MBA
Syria	Tell Qara Quzaq	TQQ_III	EBA_III
Syria	Tell Qara Quzaq	TQQ_IV	EBA_III
Syria	Tell Sabi Abyad	TSA-1_3	EC
Syria	Tell Shiukh Fawqani	TSF_BA1	EBA_I
Syria	Umm el-Marra	UEM_IIIA-C	MBA_II
Syria	Umm el-Marra	UEM_IIID	MBA_I
Syria	Umm el-Marra	UEM_V-IV	EBA
Syria	Umbashi	UMB_EBA	EBA
Syria	Umbashi	UMB_MBA	MBA
Syria	Umm Qseir	UQ	EC
Syria - Central	El Kowm I	EKIb	PN
Syria - Central	El Kowm II	EKII	final PPNB
Syria - Northwest	Tell Ras Shamra	RsVa	PN
Syria - Northwest	Tell Ras Shamra	RsVb	PN
Syria - Northwest	Tell Ras Shamra	RsVc	late PPNB
Syria (Damascus Basin)	Tell Aswad	AsII	middle PPNB
Syria (Damascus Basin)	Tell Ghoraifé	GhII	late PPNB
Syria (Damascus Basin)	Tell Ramad	RaI	late PPNB
Syria (Damascus Basin)	Tell Ramad	RaII	final PPNB
Syria (Euphrates Valley)	Tell Abu Hureyra	AH2B	middle/late/final PPNB
Syria (Euphrates Valley)	Tell Abu Hureyra	AH2C	PN
Syria (Euphrates Valley)	Bouqras	BQ	late PPNB/PN
Syria (Euphrates Valley)	Bouqras	BQs	late PPNB/PN
Syria (Euphrates Valley)	Halula	HAI	middle PPNB
Syria (Euphrates Valley)	Tell Mureybit	MuIV	EARLY/middle PPNB
Turkey	Tell Atchana	ALA_MBA	MBA
Turkey	Arslantepe	ARST	EBA_I
Turkey	Çadir Höyük	CADH-I	C
Turkey	Demircihüyük	DH	EBA
Turkey	Dilkaya Höyük	DIL	EBA
Turkey	Girikihaciyan	GH	EC
Turkey	Hacinebi Tepe	HAT-C	LC
Turkey	Hacinebi Tepe	HAT-U	LC_Uruk
Turkey	Hassek Höyük	HH-EBA	EBA
Turkey	Hassek Höyük	HH-LU	LC_Uruk
Turkey	Ilipinar	ILI	N
Turkey	Ikiztepe	IT_C	LC
Turkey	Ikiztepe	IT_EB	EBA_I
Turkey	Ikiztepe	IT_EB/MB	EBA_III
Turkey	Kaman-Kalehöyük	K-K_EB	EBA
Turkey	Korucutepe	KOR-CH	MC
Turkey	Korucutepe	KOR-EB	EBA
Turkey	Korucutepe	KOR-MB	MBA
Turkey	Kenan Tepe	KT_C	C
Turkey	Kenan Tepe	KT_EB_MB	EBA

Country/location	site_name	phase_code	period
Turkey	Kumtepe	KU_B	C
Turkey	Kurban Höyük	KUH_E_MBA	EBA
Turkey	Kurban Höyük	KUH_EBI	EBA_early
Turkey	Kurban Höyük	KUH_EBII	EBA_middle to late
Turkey	Kurban Höyük	KUH_H	EC
Turkey	Kurban Höyük	KUH_LC	LC
Turkey	Kurban Höyük	KUH_MC	MC
Turkey	Kuruçay Höyük	KUR_LC	LC
Turkey	Oylum Höyük	OH	C
Turkey	Tilbeshar	TB_C	C
Turkey	Tepecik	TEP-CH	MC
Turkey	Tepecik	TEP-EB	EBA
Turkey	Tepecik	TEP-EB_MB	EBA/MB
Turkey	Tepecik	TEP-MB	MBA
Turkey	Tepecik	TEP-MB_LB	MBA
Turkey	Titris Höyük	TH	EBA
Turkey	Tell Kurdu	TKU	EC
Turkey	Troia	TRO_I	EBA
Turkey	Troia	TRO_II	EBA
Turkey	Troia	TRO_IIAM	EBA
Turkey	Troia	TRO_IV-V	MBA
Turkey	Troia	TRO_VI	MBA
Turkey	Yarim Höyük	YAHÖ_U	LC_late Uruk
Turkey - Central	Asikli Hoyuk	AsH	middle PPNB
Turkey - Central	Catal Hoyuk	CtHIX-X	PN
Turkey - Central	Catal Hoyuk	CtHVI-VIII	PN
Turkey - Central	Catal Hoyuk	CtHXI-XII	PN
Turkey - Southeast	Cayonu	CAIb	early PPNB
Turkey - Southeast	Cayonu	CAIc	middle PPNB
Turkey - Southeast	Cayonu	CAId	late PPNB
Turkey - Southeast	Cayonu	CAIe	PPNC
Turkey - Southeast	Cayonu	CAII	PN
Turkey - Southeast	Can Hasan III	CHaIII	late/final PPNB (PPNC)?
Turkey - Southeast	Cafer Hoyuk	CHIII	early/middle PPNB
Turkey - Southwest	Erbaba	ER	PN
Turkey - Southwest	Hacilar	HrI	middle PPNB
Turkey - Southwest	Hacilar	HrII	PN

Appendix 4

Taxon codes

taxon	taxon_code	domestic_wild_status
Acacia nilotica (L.) Delile	ACACNIL	w
Acacia sp.	ACACSPE	w
Adonis aestivalis	ADONAES	w
Adonis annua L.	ADONANN	w
Adonis annua type	ADOANTY	w
Adonis dentata Del.	ADONDEN	w
Adonis flammea Jacq.	ADONFLA	w
Adonis sp.	ADONSPE	w
Aegilops crassa	AEGICRA	w
Aegilops crassa glume bases	AEGCRAG	w
Aegilops searsii	AEGISEA	w
Aegilops sp. glume bases (spikelet bases)	AEGSPGB	w
Aegilops sp. glume remains	AEGSPGR	w
Aegilops sp. grains	AEGISPE	w
Aegilops sp. rachis	AEGSPRA	w
Aegilops sp. spikelet forks (spikelets)	AEGSPSF	w
Aegilops speltoides glume bases (spikelet bases)	AEGISPG	w
Aegilops speltoides grains	AEGISPT	w
Aegilops tauschii glume bases	AEGTAUG	w
Aegilops umbellulata	AEGIUMB	w
Aegilops/Triticum	AEGTRIT	w
Aegilops/Triticum glume bases	AEGTRIG	w
Aegilops/Triticum rachis internodes	AEGTRIR	w
Aellinia sp.	AELLSPE	w
Aeluropus littoralis (Gouan) Parl.	AELULIT	w
Aeluropus sp.	AELUSPE	w
Agrimonia eupatoria L.	AGRIEUP	w
Agropyron sp.	AGRYSPE	w
Agrostemma githago	AGROGIT	w
Agrostis sp.	AGROSPE	w
Aizoon hispanicum	AIZOHIS	w
Aizoon sp.	AIZOSPE	w
Ajuga iva	AJUGIVA	w
Ajuga sp.	AJUGSPE	w
Alcea dissecta var. microchiton	ALCEDIS	w
Alhagi camelorum	ALHACAM	w
Alhagi sp.	ALHASPE	w
Alisma gramineum Lej.	ALISGRA	w
Alkanna orientalis	ALKAORI	w
Alkanna Tausch sp.	ALKASPE	w
Allium sativum	ALLISAT	d
Allium sp.	ALLISPE	w
Alopecurus sp.	ALOPSPE	w
Alyssum sp.	ALYSSPE	w
Alyssum type	ALYSTYP	w
Amaranthus retroflexus	AMARRET	w
Amaranthus sp.	AMARSPE	w
Ammi majus L.	AMMIMAJ	w
Ammi sp.	AMMISPE	w
Amygdalus argentea	AMYGARG	w
Amygdalus communis L.	AMYGCOM	d
Amygdalus sp.	AMYGSPE	w
Anagallis arvensis L.	ANAGARV	w
Anagallis sp. L.	ANAGSPE	w
Anchusa L. sp.	ANCHSPE	w
Anchusa officinalis	ANCHOFF	w

taxon	taxon_code	domestic_wild_status
Anchusa officinalis L. type	ANCOFTY	w
Andrachne sp.	ANDASPE	w
Andrachne telephioides L.	ANDRTEL	w
Androsace maxima L.	ANDRMAX	w
Androsace sp. L.	ANDRSPE	w
Anisantha/Zerna	ANISZER	w
Anisosciadium orientale	ANISORI	w
Anthemis arvensis L.	ANTHARV	w
Anthemis cotula L.	ANTHCOT	w
Anthemis pseudocotula Boiss.	ANTHPSE	w
Anthemis sp. L.	ANTHSPE	w
Anthemis wettsteiniana	ANTHWET	w
Apium cf. graveolens	APCFGRA	w
Apium graveolens	APIUGRA	w
Arabidopsis thaliana type	ARATHTY	w
Arctium lappa	ARCTLAP	w
Arenaria sp.	ARENSPE	w
Arnebia decumbens (Vent.) Cosson and Kralik	ARNEDEC	w
Arnebia decumbens (Vent.) Cosson and Kralik/Lithospermum tenuiflorum L.	ARNELIT	w
Arnebia Forssk. sp.	ARNESPE	w
Arnebia linearifolia DC.	ARNELIN	w
Arrhenatherum elatius	ARRHELA	w
Artemisia herba-alba	ARTHEAL	w
Artemisia sp. L.	ARTESPE	w
Asparagus sp.	ASPASPE	w
Asperula arvensis L.	ASPEARV	w
Asperula arvensis/orientalis	ASPAROR	w
Asperula sp.	ASPESPE	w
Asperula/Galium sp.	ASPEGAL	w
Asphodelus spp.	ASPHSPE	w
Asphodelus tenuifolius	ASPHTEN	w
Astragalus callichrous/asterias	ASTCAAS	w
Astragalus hamosus L.	ASTRHAM	w
Astragalus sp.	ASTRSPE	w
Astragalus tribuloides	ASTRTRS	w
Astragalus vogelii	ASTRVOG	w
Atriplex leucoclada	ATRILEU	w
Atriplex sp.	ATRISPE	w
Atriplex sp. fruiting bracts	ATRISPB	w
Avena fatua L.	AVENFAT	w
Avena ludoviciana	AVENLUD	w
Avena sativa	AVENSAT	d
Avena sp.	AVENSPE	w
Avena sp. awns	AVENSPA	w
Avena sterilis L.	AVENSTE	w
Avena wiestii Steudel	AVENWIE	w
Avenula sp.	AVENUSP	w
Balanites aegyptiaca Delile	BALAAEG	w
Ballota sp.	BALLSPE	w
Bellevalia sp.	BELLSPE	w
Berula erecta Hudson	BERUERE	w
Beta sp.	BETASPE	w
Beta vulgaris L.	BETAVUL	d
Bifora spp.	BIFOSPE	w
Bifora testiculata	BIFOTES	w
Brachypodium distachyon	BRACDIS	w
Brassica nigra (L.) Koch	BRASNIG	d
Brassica sp.	BRASSPE	w

taxon	taxon_code	domestic_wild_status
Brassica/Sinapis sp.	BRASSIN	w
Brassicaceae indet.	CRUCIND	w
Bromus danthoniae Trin.	BROMDAN	w
Bromus diandrus Roth	BROMDIA	w
Bromus hordeaceus type	BROHOTY	w
Bromus rigidus/sterilis	BRORIST	w
Bromus scoparius L.	BROMSCO	w
Bromus sp.	BROMSPE	w
Bromus sterilis L.	BROMSTE	w
Bromus tectorum L.	BROMTEC	w
Buglossoides arvensis (L.) Johnston	BUGLARV	w
Buglossoides Moench sp.	BUGLSPE	w
Buglossoides tenuiflora (L. fil.) Johnston	BUGLTEN	w
Bupleurum lancifolium	BUPLLAN	w
Bupleurum sp. L.	BUPLSPE	w
Bupleurum subovatum Link. ex Spreng.	BUPLSUB	w
Calendula arvensis L.	CALEARV	w
Calendula sp. L.	CALESPE	w
Calicotome villosa (Poiret) Link	CALIVIL	w
Camelina sativa (L.) Crantz	CAMESAT	d
Camphorosma spp.	CAMPSPE	w
Capparis sp.	CAPPSPE	w
Capparis spinosa L.	CAPPSPI	w
Capsella spp.	CAPSSPE	w
Carex caryophyllea Latourr.	CARECAR	w
Carex divisa Hudson	CAREDIV	w
Carex divulsa Stokes	CAREDIU	w
Carex pachystachys	CAREPAC	w
Carex sp.	CARESPE	w
Carrichtera annua	CARRANN	w
Carthamus creticus type	CARCRTY	w
Carthamus sp. L.	CARTSPE	w
Carthamus tinctorius L.	CARTTIN	d
Caryophyllaceae indet.	CARYIND	w
Cedrus sp.	CEDRSPE	w
Celtis australis L.	CELTAUS	w
Celtis sp.	CELTSPE	w
Celtis tournefortii	CELTTOU	tree - fruit bearing
Centaurea hyalolepis	CENTHYA	w
Centaurea pallescens	CENTPAL	w
Centaurea solstitialis type	CENSOTY	w
Centaurea sp. L.	CENTSPE	w
Centhrantus sp.	CENRSPE	w
Cephalaria sp. Schrader ex Roemer and Schultes	CEPHSPE	w
Cephalaria syriaca (L.) Schrader	CEPHSYR	w
Ceratocephalus falcatus	CERAFAL	w
Ceratocephalus sp.	CERATSP	w
Cereal indeterminate chaff	CERINDF	d
Cereal indeterminate culm	CERINDC	d
Cereal indeterminate grains	CERINDG	d
Cereal indeterminate rachis	CERINDR	d
Cerealia/Aegilops	CEREAEG	w
Ceruana pratensis	CERUPRA	w
Chara sp.	CHARSPE	w
Chenopodiaceae/Capparis/etc. spiral embryo indeterminate	CHENCAP	
Chenopodium album L.	CHENALB	w
Chenopodium cf. album	CHCFALB	w
Chenopodium cf. murale L.	CHCFMUR	w

taxon	taxon_code	domestic_wild_status
Chenopodium ficifolium Sm.	CHENFIC	w
Chenopodium murale L.	CHENMUR	w
Chenopodium rubrum	CHENRUB	w
Chenopodium sp.	CHENSPE	w
Chenopodium/Atriplex	CHENATR	w
Chrozophora spp.	CHROSPE	w
Chrysanthemum coronarium	CHRYCOR	w
Chrysanthemum sp.	CHRYSPE	w
Cicer arietinum L.	CICEARI	d
Cicer pinnatifidum	CICEPIN	w
Cicer sp.	CICESPE	w
Cichorium pumilum	CICHPUM	w
Cirsium sp. Miller	CIRSSPE	w
Cistanche tubulosa	CISTTUB	w
Cistus sp.	CISTSPE	w
Cistus sp. (capsule)	CISSPEC	w
Citrullus colocynthis (L.) Schrader in Linnaea	CITRCOL	w
Cladium mariscus (L.) Pohl	CLADMAR	w
Cleome chrysantha	CLEOCHR	w
Cleome ornithopodioides	CLEOORN	w
Cleome sp.	CLEOSPE	w
Conringia sp.	CONRSPE	w
Convolvulus dorycnium	CONVDOR	w
Convolvulus sp. L.	CONVSPE	w
Coriandrum sativum	CORISAT	d
Cornulaca monacantha	CORNMON	w
Cornus mas L.	CORNMAS	w
Coronilla scorpioides (L.) Koch	COROSCO	w
Coronilla sp.	COROSPE	w
Coronopus niloticus	CORONIL	w
Corylus avellana	CORYAVE	w
Cotula anthemoides	COTUANT	w
Crataegus aronia	CRATARO	w
Crataegus azarolus	CRATAZA	w
Crataegus monogyna Jacq.	CRATMON	w
Crataegus sp. L.	CRATSPE	w
Crucianella exasperata	CRUCEXA	w
Crucianella sp.	CRUCSPE	w
Crypis alopecuroides (Piller and Mitterp.) Schrader	CRYPALO	w
Crypis schoenoides (L.) Lam.	CRYPSCH	w
Crypsis sp.	CRYPSPE	w
Cucumis melo dessicated	CUCUMED	d
Cucumis melo L.	CUCUMEL	d
Cuscuta sp. L.	CUSCSPE	w
Cutandia dichotoma	CUTADIH	w
Cutandia memphitica	CUTAMEM	w
Cynodon dactylon (L.) Pers.	CYNODAC	w
Cynodon sp.	CYNOSPE	w
Cyperus articulatus	CYPEART	w
Cyperus aucheri	CYPEAUC	w
Cyperus rotundus L.	CYPEROT	w
Cyperus sp.	CYPESPE	w
Daucus carota L.	DAUCCAR	w
Digitaria sanguinalis (L.) Scop.	DIGISAN	w
Digitaria sp.	DIGISPE	w
Echinaria capitata (L.) Desf.	ECHICAP	w
Echinaria spp.	ECHNSPE	w
Echinochloa colonum (L.) Link	ECHICOL	w
Echinochloa sp.	ECHINSP	w

taxon	taxon_code	domestic_wild_status
Echium judaeum	ECHIJUD	w
Echium L. sp.	ECHISPE	w
Eleocharis sp.	ELEOSPE	w
Elymus sp.	ELYMSPE	w
Emex spinosa	EMEXSPI	w
Epilobium type	EPILTYP	w
Eragrostis barrelieri	ERAGBAR	w
Eragrostis minor Host	ERAGMIN	w
Eragrostis sp.	ERAGSPE	w
Eremopyrum bonaepartis	EREMBON	w
Eremopyrum bonaepartis/confusum	EREBOCO	w
Eremopyrum sp.	EREMSPE	w
Eremopyrum sp. rachis	EREMSPR	w
Erodium sp.	ERODSPE	w
Erucaria hispanica/boveana	ERUHIBO	w
Erucaria sp.	ERURSPE	w
Euclidium syriacum (L.) R.	EUCLSYR	w
Eupatorium sp.	EUPASPE	w
Euphorbia cuspidata	EUPHCUS	w
Euphorbia exigua/arvalis type	EUEXATY	w
Euphorbia falcata	EUPHFAL	w
Euphorbia helioscopia L.	EUPHHEL	w
Euphorbia peplus	EUPHPEP	w
Euphorbia sp.	EUPHSPE	w
Fabaceae indet.	LEGUIND	w
Fabaceae indeterminate large	LEGUINL	w
Fabaceae indeterminate small	LEGUINS	w
Fabaceae sat. indet.	LEGUSAT	d
Festuca/Lolium sp.	FESTLOL	w
Ficus carica L.	FICUCAR	d
Ficus sp.	FICUSPE	w
Fimbristylis bisumbellata (Forsskål) Bubani	FIMBBIS	w
Fimbristylis sp.	FIMBSPE	w
Fumaria densiflora	FUMADEN	w
Fumaria officinalis L.	FUMAOFF	w
Fumaria officinalis L. type	FUOFTYP	w
Fumaria parviflora/densiflora	FUMPADE	w
Fumaria sp.	FUMASPE	w
Galium aparine L.	GALIAPA	w
Galium aparine/spurium	GALAPSP	w
Galium mollugo	GALIMOL	w
Galium sp.	GALISPE	w
Galium spurium L.	GALISPU	w
Galium tricorne	GALITRE	w
Galium tricornutum Dandy	GALITRI	w
Galium verum	GALIVER	w
Garhadiolus angulosus	GARHANG	w
Genista sp.	GENISPE	
Geranium dissectum L.	GERADIS	w
Geranium sp.	GERASPE	w
Glaucium corniculatum (L.) Rud.	GLAUCOR	w
Glaucium sp.	GLAUSPE	w
Glinus sp.	GLINSPE	w
Gypsophila elegans	GYPSELE	w
Gypsophila obionica	GYPSOBI	w
Gypsophila pilosa Hudson	GYPSPIL	w
Gypsophila sp.	GYPSSPE	w
Haplophyllum tuberculatum	HAPLTUB	w
Helianthemum salicifolium (L.) Miller	HELISAL	w

taxon	taxon_code	domestic_wild_status
Helianthemum sp.	HELISPE	w
Heliotropium europaeum L.	HELOEUR	w
Heliotropium L. sp.	HELOSPE	w
Heliotropium suaveolens	HELOSUA	w
Herniaria cinerea	HERNCIN	w
Herniaria sp.	HERNSPE	w
Hibiscus esculentus	HIBIESC	w
Hippocrepis sp.	HIPPSPE	w
Hippocrepis unisiliquosa L.	HIPPUNI	w
Hirschfeldia incana	HIRSINC	w
Holosteum spp.	HOLOSPE	w
Hordeum bulbosum	HORDBUL	w
Hordeum geniculatum All.	HORDGEN	w
Hordeum glaucum	HORDGLA	w
Hordeum marinum type	HORMATY	w
Hordeum murinum L.	HORDMUR	w
Hordeum murinum type	HORMUTY	w
Hordeum sativum grains (2-row hulled)	HORDSAT	d
Hordeum sativum grains (6 row hulled)	HORDSAS	d
Hordeum sativum grains (6 row naked)	HORDVUN	w
Hordeum sativum grains (indeterminate hulled)	HORDSAI	d
Hordeum sativum hulled or naked grains	HORSASN	d
Hordeum sativum hulled or naked rachis internodes	HORSSNR	d
Hordeum sativum naked grains	HORDSAN	d
Hordeum sativum naked rachis internodes	HORDSNR	d
Hordeum sativum rachis internodes	HORDSRA	d
Hordeum sativum rachis internodes (2-row hulled)	HORDSRT	d
Hordeum sativum rachis internodes (6-row hulled)	HORDSRS	d
Hordeum sativum rachis internodes (indeterminate hulled)	HORDSRI	d
Hordeum sp. (imprints)	HORDSPE	w
Hordeum sp. (wild)	HORDSPW	w
Hordeum sp. glume remains	HORDSPG	w
Hordeum sp. grains	HORDSPC	w
Hordeum sp. rachis internodes	HORDRAI	w
Hordeum spontaneum Koch	HORDSPO	w
Hordeum spontaneum rachis internodes	HORDSPR	w
Hordeum spontaneum/sativum grains	HORSPSA	w
Hordeum spontaneum/sativum rachis internodes	HORSPSR	wild/domestic cereal
Hordeum/Secale rachis internodes	HORSECR	w
Hyoscyamus muticus	HYOSMUT	w
Hyoscyamus niger L.	HYOSNIG	w
Hyoscyamus sp.	HYOSSPE	w
Hypecoum sp.	HYPCSPE	w
Hypericum sp.	HYPESPE	w
indeterminata	INDETER	w
Indigofera articulata	INDIART	w
Isatis spp.	ISATSPE	w
Isoëtes duriei Bory	ISOEDUR	w
Isoëtes histrix Bory	ISOEHIS	w
Juncus rigidus	JUNCRIG	w
Juncus sp.	JUNCSPE	w
Juniperus sp.	JUNISPE	w
Koelpinia linearis	KOELLIN	w
Lappula Fabricius sp.	LAPPSPE	w
Lathyrus cicera L.	LATHCIC	w
Lathyrus cicera/sativus	LATCISA	d
Lathyrus hirsutus L.	LATHHIR	w
Lathyrus nissolia	LATHNIS	w

taxon	taxon_code	domestic_wild_status
Lathyrus sativus L.	LATHSAT	d
Lathyrus sp.	LATHSPE	w
Lemna sp.	LEMNSPE	w
Lens culinaris Medik.	LENSCUL	d
Lens orientalis	LENSORI	wild pulse
Lens sp.	LENSSPE	d
Leontodon sp. L.	LEONSPE	w
Lepidium sativum pod	LEPISAP	d
Lepidium sp.	LEPISPE	w
Limonium	LIMOSPE	w
Linaria sp.	LINASPE	w
Linum bienne	LINUBIE	wild oil/fibre plant
Linum sp.	LINUSPE	w
Linum strictum L.	LINUSTR	w
Linum usitatissimum L.	LINUUSI	d
Linum usitatissimum L. capsule	LINUSIC	w
Linum usitatissimum L. dessicated	LINUUSD	d
Linum usitatissimum L. dessicated capsule	LINUUCD	d
Lithospermum arvense L.	LITHSPM	w
Lithospermum L. sp.	LITHSPE	w
Lolium perenne L.	LOLIPER	w
Lolium perenne type	LOLPETY	w
Lolium persicum type	LOLPSTY	w
Lolium remotum Schrank	LOLIREM	w
Lolium remotum type	LOLRETY	w
Lolium rigidum Gaudin	LOLIRIG	w
Lolium rigidum/perenne	LOLRIPE	w
Lolium rigidum/temulentum	LOLRITE	w
Lolium sp.	LOLISPE	w
Lolium sp., rachis	LOLISPR	w
Lolium temulentum L.	LOLITEM	w
Lophochloa sp.	LOPHSPE	w
Lupinus sp.	LUPISPE	w
Lycopus sp.	LYCOSPE	w
Lygia pubescens	LYGIPUB	w
Lythrum salicaria L.	LYTHSAL	w
Malcomia spp.	MALCSPE	w
Malva aegyptia	MALVAEG	w
Malva nicaeensis	MALVNIC	w
Malva parviflora L.	MALVPAR	w
Malva pusilla Sm.	MALVPUS	w
Malva sp.	MALVSPE	w
Malva sylvestris L.	MALVSYL	w
Malvaceae indet.	MALVIND	w
Matricaria sp. L.	MATRSPE	w
Medicago lacinata	MEDILAC	w
Medicago orbicularis (L.) Bart.	MEDIORB	w
Medicago radiata L.	MEDIRAD	w
Medicago rotata Boiss.	MEDIROT	w
Medicago rugosa	MEDIRUG	w
Medicago sp.	MEDISPE	w
Medicago sp. Sect. Spirocarpos Ser. (pod)	MEDISPO	w
Medicago truncatula	MEDITRU	w
Medicago tuberculata	MEDITUB	w
Melilotus segetalis/sulcatus	MELSESU	w
Melilotus sp.	MELISPE	w
Melilotus/Trifolium	MELITRI	w
Micromeria sp.	MICRSPE	w
Minuartia hybrida	MINUHYB	w

taxon	taxon_code	domestic_wild_status
Minuartia sp.	MINUSPE	w
Morus sp.	MORUSPE	w
Muscari sp.	MUSCSPE	w
Nepeta sp.	NEPESPE	w
Neslia paniculata	NESLPAN	w
Neslia sp.	NESLSPE	w
Noaea mucronata	NOAEMUC	w
Olea europaea L.	OLEAEUR	d
Olea sp. L.	OLEASPE	w
Onobrychis caput-galli (L.) Lam.	ONOBCAP	w
Onobrychis crista-galli	ONOBCRG	w
Onobrychis sp.	ONOBSPE	w
Onobrychis sp. pod	ONOBSPP	w
Ononis ornithopodioides L.	ONONORN	w
Ononis viscosa L.	ONONVIS	w
Onopordum sp. L.	ONOPSPE	w
Onosma L. sp.	ONOSSPE	w
Origanum vulgare L.	ORIGVUL	w
Ornithogalum sp.	ORNISPE	w
Oryzopsis sp.	ORYZOSP	w
Panicum miliaceum	PANIMIL	d
Panicum sp.	PANISPE	w
Panicum turgidum	PANITUR	w
Papaver dubium	PAPADUB	w
Papaver rhoeas L.	PAPARHO	w
Papaver sp.	PAPASPE	w
Papaver/Roemeria	PAPAROE	w
Paronychia sp.	PAROSPE	w
Peganum harmala L.	PEGAHAR	w
Phalaris aquatica/paradoxa	PHAAQPA	w
Phalaris canariensis	PHALCAN	
Phalaris minor Retz	PHALMIN	w
Phalaris paradoxa L.	PHALPAR	w
Phalaris sp.	PHALSPE	w
Phalaris/Alopecurus	PHALALO	w
Phleum sp.	PHLESPE	w
Phleum type	PHLETYP	w
Phleum/Eragrostis	PHLEERA	w
Phlomis spp.	PHLOSPE	w
Phoenix dactylifera L.	PHOEDAC	d
Phragmites australis (Cav.) Trin.	PHRAAUS	w
Phragmites sp.	PHRASPE	w
Physalis alkekengi L.	PHYSALK	w
Physalis sp.	PHYSSPE	w
Picris hieracioides L.	PICRHIE	w
Picris sp. L.	PICRSPE	w
Pimpinella cretica	PIMPCRE	w
Pimpinella spp.	PIMPSPE	w
Pinus pinea	PINUPIN	w
Pinus sp.	PINUSPE	w
Pistacia atlantica Desf.	PISTATL	d
Pistacia atlantica/palaestina	PIATLPA	d
Pistacia khinjuk	PISTKHI	w
Pistacia palaestina	PISTPAL	d
Pistacia sp.	PISTSPE	w
Pistacia terebinthus L.	PISTTER	w
Pistacia terebinthus/lentiscus	PISTELE	w
Pisum elatius Bieb.	PISUELA	w
Pisum sativum L.	PISUSAT	d

taxon	taxon_code	domestic_wild_status
Pisum sp.	PISUSPE	w
Pisum/Lathyrus sp.	PISULAT	d
Pisum/Vicia sp.	PISUVIC	d
Plantago arenaria type	PLAARTY	w
Plantago lanceolata	PLANLAN	w
Plantago loeflingii	PLANLOE	w
Plantago sp.	PLANSPE	w
Poa bulbosa	POABULB	w
Poaceae indet.	GRAMIND	w
Poaceae indet. large	GRAINLA	w
Poaceae indet. small	GRAINSM	w
Polycnemum majus A.Braun	POLCMAJ	w
Polygonum aviculare L.	POLYAVI	w
Polygonum aviculare/patulum	POLAVPA	w
Polygonum convolvulus L.	POLYCON	w
Polygonum corregioloides	POLYCOR	w
Polygonum lapathifolium/salicifolium	POLLASA	w
Polygonum persicaria L.	POLYPER	w
Polygonum rurivagum type	POLRUTY	w
Polygonum salicifolium Brouss.	POLYSAL	w
Polygonum sp.	POLYSPE	w
Polygonum/Rumex sp.	POLYRUM	w
Polypogon sp.	POLYPSP	w
Portulaca oleracea L.	PORTOLE	d
Portulaca oleracea subsp. stellata	PORTOST	w
Portulaca sp.	PORTSPE	w
Potamogeton sp.	POTASPE	w
Potentilla sp.	POSPEUC	w
Potentilla supina L.	POTESUP	w
Prosopis farcta (Banks and Sol.) Macbride in Contrib. Gray Herb	PROSFAR	w
Prosopis sp.	PROSSPE	w
Prosopis/Citrillus spp.	PROSCIT	w
Prunus domestica L.	PRUNDOM	d
Prunus insititia L.	PRUNINS	d
Prunus microcarpa	PRUNMIC	w
Prunus persica (L.) Batsch	PRUNPER	w
Prunus sp.	PRUNSPE	d
Psilurus incurvus (Gouan) Schinz and Thell.	PSILINC	w
Pulicaria crispa	PULICRI	w
Pulicaria sp.	PULISPE	w
Punica granatum L.	PUNIGRA	d
Punica granatum L. fruit	PUNGRAF	d
Punica sp. L.	PUNISPE	w
Pyrus sp. L.	PYRUSPE	w
Pyrus/Malus sp.	PYRUMAL	d
Quercus sp.	QUERSPE	w
Ranunculus arvensis L.	RANUARV	w
Ranunculus repens L.	RANUREP	w
Ranunculus sp.	RANUSPE	w
Raphanus sp.	RAPHSPE	w
Reboudia pinnata	REBOPIN	w
Reseda alba	RESEALB	w
Reseda decursiva	RESEDEC	w
Reseda luteola L.	RESELUL	w
Reseda sp.	RESESPE	w
Rhagadiolus sp. Scop.	RHAGSPE	w
Rhagadiolus stellatus	RHAGSTE	w
Rhamnus disperma	RHAMDIS	w

taxon	taxon_code	domestic_wild_status
Rhamnus punctata	RHAMPUN	w
Ricinus communis L.	RICICOM	w
Roemeria hybrida	ROEMHYB	w
Rosa sp. L.	ROSASPE	w
Rubus caesius L.	RUBUCAE	w
Rubus fruticosus agg.	RUBUFRU	w
Rubus idaeus L.	RUBUIDA	w
Rubus sanctus	RUBUSCT	w
Rubus sanguineus	RUBUSAN	w
Rubus sp.	RUBUSPE	w
Rumex acetosella L.	RUMEACE	w
Rumex conglomeratus Murray	RUMECON	w
Rumex conglomeratus type	RUMCOTY	w
Rumex cristatus/conglomeratus	RUMCRCO	w
Rumex dentatus L.	RUMEDEN	w
Rumex pulcher L.	RUMEPUL	w
Rumex pulcher type	RUMEPUT	w
Rumex sanguineus L.	RUMESAN	w
Rumex simpliciflorus	RUMESIM	w
Rumex sp.	RUMESPE	w
Salsola inermis	SALSINE	w
Salsola kali L.	SALSKAL	w
Salsola sp.	SALSSPE	w
Salsola volkensii	SALSVOL	w
Sambucus nigra	SAMBNIG	w
Sambucus sp.	SAMBSPE	w
Sanguisorba minor Scop.	SANGMIN	w
Sanguisorba sp.	SANGSPE	w
Sarcopoterium spinosum (L.) Spach	SARCSPI	w
Schoenoplectus litoralis (Schrader) Palla	SCHOLIT	w
Schoenoplectus sp.	SCHOSPE	w
Schoenoplectus triqueter	SCHOTRI	w
Schoenus nigricans L.	SCHONIG	w
Scirpus lacustris	SCIRLAC	w
Scirpus maritimus	SCIRMAR	w
Scirpus setaceus	SCIRSET	w
Scirpus sp.	SCIRSPE	w
Scirpus/Schoenoplectus sp.	SCIRSCH	w
Scleranthus sp.	SCLESPE	w
Scorpiurus muricatus L.	SCORMUR	w
Scorpiurus sp.	SCORSPE	w
Scorpiurus subvillosa L.	SCORSUB	w
Scorzonera judaica	SCORJUD	w
Scrophularia desertii	SCRODES	w
Scrophularia sp.	SCROSPE	w
Secale cereale grains	SECACEG	d
Secale cereale rachis	SECACER	d
Secale cereale ssp. segetale grains	SECASEG	wild cereal
Secale montanum/vavilovii grains	SECMOVA	wild cereal
Secale montanum/vavilovii rachis	SECMOVR	wild cereal
Securigera securidaca (L.) Degen and Doerf.	SECUSEC	w
Senecio aegyptus	SENEAEG	w
Senecio sp. L.	SENESPE	w
Setaria sp.	SETISPE	w
Setaria verticillata (L.) P. Beauv.	SETAVER	w
Setaria viridis (L.) P. Beauv.	SETAVIR	w
Setaria/Panicum sp.	SETAPAN	w
Sherardia arvensis L.	SHERARV	w
Sherardia sp.	SHERSPE	w

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Silene armeria L.	SILEARM	w
Silene conoidea L.	SILECOD	w
Silene gallica L.	SILEGAL	w
Silene sp.	SILESPE	w
Silene sp. capsule	SILESPC	w
Silene trinervis	SILETRI	w
Silene vivianii	SILEVIV	w
Sinapis arvensis L.	SINAARV	d
Sinapis sp.	SINASPE	w
Sisymbrium irio	SISYIRI	w
Sisymbrium spp.	SISYSPE	w
Solanum dulcamara	SOLADUL	w
Solanum nigrum L.	SOLANIG	w
Solanum sp.	SOLASPE	w
Sonchus oleraceus L.	SONCOLE	w
Sophora spp.	SOPHSPE	w
Sparganium sp.	SPARSPE	w
Spergularia marina type	SPEMATY	w
Spergularia sp.	SPERSPE	w
Stachys arabica	STACARA	w
Stachys sp.	STACSPE	w
Stellaria media (L.) Vill.	STELMED	w
Stellaria sp.	STELSPE	w
Stipa sp.	STIPSPE	w
Suaeda fruticosa	SUAEFRU	w
Suaeda maritima	SUAEMAR	w
Suaeda sp.	SUAESPE	w
Syrax officinalis	STYROFF	w
Taeniatherum caput-medusae (L.) Nevski	TAENCAM	w
Taeniatherum caput-medusae/crinitum	TAECACR	w
Taeniatherum crinitum spikelet	TAENCRS	w
Taeniatherum spp.	TAENSPE	w
Teucrium botrys	TEUCBOT	w
Teucrium polium L.	TEUCPOL	w
Teucrium sp.	TEUCSPE	w
Teucrium spinosum L.	TEUCSPI	w
Teucrium/Ajuga sp.	TEUCAJU	w
Texiera glastifolia	TEXIGLA	w
Thalictrum lucidum L.	THALLUC	w
Thymelaea hirsuta (L.) Endl.	THYMHIR	w
Thymelaea passerina (L.) Cosson and Germ.	THYMPAS	w
Thymelaea sp.	THYMSPE	w
Torilis leptophylla (L.) Reichb.	TORILEP	w
Torilis sp. Adans.	TORISPE	w
Torularia torulosa	TORUTOR	w
Trachynia distachya (L.) Link	TRACDIS	w
Tribulus terrestris L.	TRIBTER	w
Trifolium sp.	TRIFSPE	w
Trigonella arabica	TRIGARA	w
Trigonella astroites Fisch. and Mey.	TRIGAST	w
Trigonella coelesyriaca Boiss.	TRIGCOY	w
Trigonella monantha A.Meyer	TRIGMON	w
Trigonella monspeliaca L.	TRIGMOS	w
Trigonella noeana	TRIGNOE	w
Trigonella radiata	TRIGRAD	w
Trigonella sp.	TRIGSPE	w
Trigonella/Astragalus sp.	TRIASTR	w
Triticum aestivum/spelta grains	TRIFHSP	d
Triticum boeoticum glume bases	TRITBOG	wild cereal

taxon	taxon_code	domestic_wild_status
Triticum boeoticum grains (1/2g)	TRITBOE	w
Triticum boeoticum grains (1g)	TRITBOO	w
Triticum boeoticum grains (2g)	TRITBOT	wild cereal
Triticum boeoticum spikelet forks	TRITBOS	w
Triticum boeoticum/monococcum glume bases	TRIBOMG	wild/domestic cereal
Triticum boeoticum/monococcum grains	TRIBOMO	w
Triticum boeoticum/monococcum spikelet forks	TRIBOMS	wild/domestic cereal
Triticum boeoticum/Secale montanum grains	TRBOSEM	wild cereal
Triticum dicoccoides grains	TRITDID	wild cereal
Triticum dicoccoides spikelet forks	TRIDIDS	d
Triticum dicoccum glume bases	TRITDIG	d
Triticum dicoccum grains	TRITDIC	d
Triticum dicoccum grains (1g)	TRITDIO	d
Triticum dicoccum spikelet fork terminal	TRITDIT	d
Triticum dicoccum spikelet forks	TRITDIS	d
Triticum dicoccum/aestivum	TRIDCAE	w
Triticum dicoccum/aestivum spikelet	TRIDCAS	w
Triticum dicoccum/dicoccoides grains	TRIDCDD	w
Triticum dicoccum/durum	TRITDDU	w
Triticum dicoccum/spelta grains	TRIDISP	d
Triticum monococcum glume bases	TRITMOG	d
Triticum monococcum grains (1/2g)	TRITMON	d
Triticum monococcum grains (1g)	TRITMOO	d
Triticum monococcum grains (2g)	TRITMOT	d
Triticum monococcum spikelet forks	TRITMOS	d
Triticum monococcum/dicoccum glume bases	TRIMODG	d
Triticum monococcum/dicoccum grains	TRIMODI	d
Triticum monococcum/dicoccum spikelet forks	TRIMODS	d
Triticum sp. 'speltoid' type	TRITSPT	w
Triticum species free threshing wheat hexaploid grains	TRITFTH	d
Triticum species free threshing wheat hexaploid rachis	TRIFTHR	d
Triticum species free threshing wheat tetraploid grains	TRITFTT	d
Triticum species free threshing wheat tetraploid rachis	TRIFTTR	d
Triticum species indeterminate fr thr/dicoccum wheat grains	TRITADD	w
Triticum species indeterminate fr thr/gl wheat grains	TRITSPE	d
Triticum species indeterminate fr thr/gl wheat rachis	TRITSPR	d
Triticum species indeterminate free threshing wheat grains	TRITFTW	d
Triticum species indeterminate free threshing wheat rachis	TRITFTR	d
Triticum species indeterminate glume wheat glume bases	TRIGLWG	d
Triticum species indeterminate glume wheat grains	TRITGLW	d
Triticum species indeterminate glume wheat spikelet forks	TRIGLWS	d
Triticum spelta grains	TRITSPL	d
Triticum/Secale	TRITSEC	d
Typha latifolia L.	TYPHLAT	w
Typha sp.	TYPHSPE	w
Urtica dioica L.	URTIDIO	w
Urtica pilulifera L.	URTIPIL	w
Urtica sp.	URTISPE	w
Utricularia sp. L.	UTRISPE	w
Vaccaria hispanica	VACCHIP	w
Vaccaria pyramidata Medik.	VACCPYR	w
Vaccaria sp.	VACCSPE	w
Valerianella coronata (L.) DC.	VALECOR	w
Valerianella dentata (L.) Pollich	VALEDEN	w
Valerianella lasiocarpa (Stev.)	VALELAS	w
Valerianella sp. Miller	VALESPE	w

taxon	taxon_code	domestic_wild_status
Valerianella vesicaria type	VALEVET	w
Verbascum sp.	VERBSPE	w
Verbascum sp. capsules	VERBSPC	w
Verbena officinalis L.	VEREOFF	w
Verbena sp.	VERESPE	w
Veronica hederifolia L.	VEROHED	w
Veronica persica Poiret	VEROPER	w
Veronica sp.	VEROSPE	w
Vicia ervilia (L.) Willd.	VICIERV	d
Vicia faba L.	VICIFAB	d
Vicia galilaea Plitm. and Zoh.	VICIGAL	w
Vicia narbonensis L.	VICINAR	w
Vicia sativa L.	VICISAT	d
Vicia sp.	VICISPE	d
Vicia/Lathyrus	VICILAT	w
Vicia/Pisum	VICIPIS	d
Viola sp.	VIOLSPE	w
Vitis sp.	VITISPE	w
Vitis sp. fruit	VITISPF	w
Vitis sylvestris Gmelin	VITISYL	w
Vitis vinfera L. stalks	VITIVIS	d
Vitis vinifera L. fruits	VITIVIF	d
Vitis vinifera L. pips	VITIVIN	d
Zilla spinosa	ZILLSPI	w
Ziziphora sp.	ZIZISPE	w
Ziziphus spina-christi var. aucheri (Boiss.) M.Qaiser and S.Nazimuddin	ZIZISPC	d